iRIS 350X Datalogger Reference Manual

For Software Version: V1.30+
(Requires Firmware Version: V1.30+)

Revision History			
Issue 1	Version 1.30	27th April 2011	Preliminary release. Adapted from the iRIS User Guide V1.60 for iRIS 220, iRIS 320 and iRIS 350.

Disclaimer

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All examples and diagrams shown in this manual and any supplied software examples are intended as a guide to understanding this product, not to guarantee operation. iQuest (NZ) Ltd accepts no responsibility for use of this product based on this information or these examples. Owing to the wide variety of possible applications of this product, you must satisfy yourself as to its suitability to your specific application.

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1 Introduction

1.1 About this Reference Manual

This reference manual is intended as a detailed guide for the installation, configuration and operation of the iRIS 350X datalogger.

This manual is also available on-line in Adobe Acrobat® PDF format for registered users at www.iquest.co.nz

Throughout this document, small icons are used to identify additional information. These are as follows:

NOTE ***Indicates extra detail to expand the current discussion.***

WARNING ***Describes something that may cause problems if not heeded.***

The term "iRIS" is used throughout this manual in reference to the iRIS 350X datalogger.

1.2 Support

Technical support for the iRIS 350X datalogger is available by contacting:

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For latest information and software updates, visit the iQuest (NZ) Ltd web site at www.iquest.co.nz.

Access to the client area on the website requires a log-in which is can also be used to access the iQuest forum. Self-registration is available by visiting the forum home page.

2 Overview

2.1 Introduction

The iRIS 350X (**i**Quest **R**emote **I**nformation **S**ource) datalogger range has been designed as cost effective, low power, self-contained information source for use in a wide range of data gathering and logging applications.

The iRIS achieves network connectivity through the use of an integral wireless modem. Depending on the version and target market, this modem will be one of the following:

- Multi-band 900/1800/1900 MHz Wavecom 2406 or Q24+ GSM/GPRS in older iRIS 350 hardware.
- Multi-band 3G HSDPA/WCDMA (for example Telecom XT® in New Zealand and Telstra NextG® in Australia). This may be either a Maxon 6280 module in older iRIS 350 hardware or a Wavecom (Sierra Wireless) Q26 Extreme module in current production units.

2.2 Features

	Wireless IP Mode	*SMS Mode*	*CSD Mode*	*Voice Annunciation Support*	*IRIS-CAM Camera Support*	*Digital inputs (pulse, frequency counter)*	*Analogue Inputs (0-5V or 0-20mA)*	*Digital Control Outputs*	*SDI-12 Interface*	*RS-232 Interface*	*Number of Simultaneous Logging Channels*	*Internal Temperature Logging*	*Internal Battery Logging*	*Supply Voltage Logging*	*Alarms per Channel*	*Rated at IP65 or better*	*Heavy Duty Aluminium Case*	*Internal 3.6V Lithium Backup Battery*	*Internal 12V Rechargeable Battery*	*Internal Battery Charger*	*Direct Solar Panel Connection*	*External RF Antenna Connector (SMA)*	*Keypad / LCD*
iRIS 350X	•	•			•	2	4	2	•	•	20	•	•	•	6	•	•	•	•	•	•	•	•
iRIS 350XV	•	•		•		2	4	2	•	•	20	•	•	•	6	•	•	•	•	•	•	•	•

Table 1 - Feature Summary

2.3 Typical Applications

The iRIS can be used for a wide range of diverse applications, including but not limited to:

- Rainfall measurement
- River level monitoring
- Water / power / gas metering
- Remote control
- Wind measurement
- Mobile temperature monitoring
- Irrigation monitoring / control
- IP ←→ RS232 communications gateway

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Key Features

2.3.1 Terminal Configuration

All configuration and set-up parameters are modified via a standard ASCII terminal connected to the RS232 serial interface. This means that the user can configure the device without needing specialised configuration software installed on their computer specifically for this purpose. Refer to Section 4.3 for details on the terminal setup.

A facility for configuring sensor and alarm parameters is provided in iLink (from version 3.5.2.3 onwards). This uses a graphical point-and-click interface and the settings can be retrieved from or sent to the logger via any available communication channel. The configuration can also be saved to or loaded from disk. Please see Section 7.

2.3.2 Wireless IP Connectivity

Wireless Internet Protocol connectivity is provided via the on-board modem. Through this interface it is possible to perform configuration changes and retrieve logged data. To facilitate IP connectivity, a suitably activated SIM card must be inserted in the device. It is also necessary to program the unit with appropriate IP connection settings through a terminal connected to the RS232 serial interface.

The iRIS communicates using IP over a wireless network using either UDP or TCP protocol.

2.3.3 Alternative Wireless Connectivity (SMS)

Another wireless connection mode other than IP is also possible. This is **SMS** (Short Message Service). As with the IP mode described above in Section 2.3.2, using the SMS service requires a SIM card with the SMS service enabled by the service provider.

The SMS option works by sending a preset text message to up to two destination cell phones or SMS receivers. This message contains the iRIS site identification and the current values of all enabled sensors. See Section 5.3 for more information on using the SMS feature.

Irrespective of the modem call-back mode setting (IP or SMS), the iRIS will only respond to incoming SMS requests when it is not connected in IP mode. The modem call-back mode setting only changes the service that is used to notify an alarm or generate a communications test. In this case, the selected service and destination phone numbers are used to send a text message (SMS).

2.3.4 Power Management

The iRIS supports four power management modes which are described below. Power management features that operate in all modes include:

- Deactivation of RS232 driver i.c when the DSR signal is not present (unless the unit is active in RS232 telemetry mode).
- Turning off the backlight after a period of inactivity when no user is logged-in.
- Ability to activate an IP session at scheduled times of day for pre-set period even if the modem is otherwise disabled in full power save mode.

No Power Save

With power management disabled, the internal wireless modem is maintained in a powered on state even if an IP session is not currently active. While in this state, periodic signal strength measurements are made and it is possible to interrogate the internal modem using the AT command set via a terminal connected to the serial interface. All on-board communication, I/O and all status LED's are permanently enabled in this mode.

Partial Power Save

With the power management mode set to Partial Save, the on-board LEDs are disabled but the internal wireless modem remains in the same fully active state as in the No Power Save mode.

Full Power Save

When power management is set to full save mode, the internal LEDs are disabled and the internal wireless modem remains in a powered off state until a wireless session is activated by the scheduler, a user or an alarm (if this feature is enabled).

While the modem is in this state, it is not possible to obtain signal strength measurements or interrogate the modem via the AT command set using the Modem Terminal mode as the modem is shut down.

RS232 Only

This mode is provided for applications where the internal modem is not used and telemetry is achieved by a data radio or modem connected to the RS232 port. When in this mode, the RS232 port is used for all call-back communication. The RS232 port behaviour also changes depending on whether the iRIS is in "Normal" or "Telemetry" mode. See Section 9 RS232 Interface Telemetry for further details on RS232 telemetry communications.

2.3.5 Data Logging

The iRIS supports the logging of data from up to twenty virtual sensors. Each of the virtual sensors can obtain information from one of the following data sources:

- Analogue input on AIN1 – AIN4
- Pulse counter attached to DIO1 - DIO4
- Simulated pulse counter enabled by DIO1 - DIO4
- Frequency counter attached to DIO1 or DIO2
- Up/down counter attached to DIO1 and DIO2 simultaneously
- Internal database location (for values obtained via user script or communications link)
- High-speed serial instrument (Unidata format – 2 byte only)
- SDI-12 instrument channel
- Quadrature shaft encoder attached to DIO1 and DIO2 simultaneously
- Change of status on charger input (dc supply)
- Battery voltage
- Supply voltage
- Logger temperature
- Received Signal Strength Indication (RSSI)
- Derived via a lookup table (e.g. flow rate) sourced from sensor 1's measured value.

Each sensor can be set up to scale the raw data source into engineering units through the application of a multiplier and offset (slope and constant). The scaled value can be logged to non-volatile memory at rates between once per minute to once per hour or immediately in true event mode for pulse inputs.

As all logged data is stored in integer format, a logging multiplier is applied to the scaled value to maintain resolution. See Section 4.4.10, Option 7 for details on configuring the logging multiplier on a sensor.

It is also possible to configure a sensor to also log associated values such as minimum, maximum, standard deviation (for all source types) or a calculated flow rate or volume (pulse type sources only). See the next section and also Section 4.4.10 for further details on configuring these extended logging features as part of the Sensor Cfg menus.

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2.3.6 Logged Data Array Identification

Each sensor's logged data is identified by an array ID number. For the primary logged data, the ID is the sensor number itself. For the optional supplementary data (min, max, deviation, flow/vol), the array ID has an offset added to the sensor number that it is associated with. These ID offsets are as follows:

Minimum:	+20
Maximum:	+40
Deviation:	+60
Flow/Vol	+80

For example, Sensor 4 has been configured to log the average value, plus the maximum and standard deviation. Three data arrays will be logged for this sensor at each logging interval with IDs of 4, 44 and 64 respectively. In HydroTel these require point identifiers of 4/0, 44/0 and 64/0 respectively.

Array 0 (zero) is a special array identifier and is used as a system event log. Currently this is only used to log a restart (either at the initial connection of power, on a watchdog reset or a user program start after an upgrade). The logged value in this case contains a value that can be decoded to determine the cause of the restart. In HydroTel the identifier for this item is 0/0.

2.3.7 Alarm Processing

Each virtual sensor can be configured for up to six separate alarm conditions. Each alarm has separate trigger and reset levels, and also an activation delay or accumulation period depending upon the data type.

The iRIS also maintains a global flag that is set if any alarm in the unit is active. This can be used to control the digital outputs or trigger a camera image for the iRIS-CAM variant. See Sections 3.3.5 and 4.4.15 for further details on digital outputs.

2.3.8 Real Time Clock & Calendar

The iRIS has a non-volatile real time clock that can be set by the user either through a terminal (RS232 or IP) or remotely via proprietary iQuest protocol commands from software such as HydroTel™ or iLink. To enable user adjustment to minimise clock drift, a menu option is provided to set a compensation offset for fine control. See Section 4.4.17.

2.3.9 Security

The iRIS can be configured with a PIN code to prevent unauthorised access to restricted information through the LCD and keypad. This is especially useful when the iRIS is installed in a location where it is accessible to the general public.

A second level of security is also provided to prevent access to the terminal via a serial connection. This is achieved by a security string that if used requires correct entry before access to the terminal is granted. See Section 4.2 for more details on using the security string.

2.3.10 Gateway Communication

The iRIS supports iQuest protocol gateway functionality between the wireless network and the RS232 serial interface. This enables the unit to be used as a bridge between the wide area wireless network and a localised radio or other network. It is possible to connect a datalogger that does not have wireless capability such as the iQuest DS-4483 to the serial port of the iRIS and communicate with it via the gateway. Also, by connecting a data radio to the unit's serial port it is possible to communicate with several devices in a multi-drop radio network from the wireless network.

When the gateway option is enabled, any data packets that are **not** addressed to the iRIS and match the gateway criteria are readdressed and redirected. The port that the redirected packet is sent from depends on the configuration of the iRIS.

Refer to Section 9 - RS232 Interface Telemetry for further information on using the gateway.

2.4 iRIS 350 and iRIS 350X Comparison

The iRIS 350X is an enhanced firmware/software set that makes full use of the expanded hardware capability the iRIS 350 had over the earlier iRIS220/320 models. The previous (standard) firmware/software was intentionally similar to the older iRIS models for ease of migration. However, there are many applications where the expanded capacity is required, so the X variant has been created and will become the only firmware/software developed and supported in the future.

Because the changes are very significant, the decision was been made to change the upgraded iRIS 350 personality to a different model. This affects both HydroTel and iLink. The key differences between the two models are:

	iRIS 350	**iRIS 350X**
Integer database	2560 locations	10000 locations
Floating Point database	10 locations	100 locations
Logging Sensors	6 “free-format” sensors + 3 fixed (internal) sensors.	20 “free-format” sensors. The internal sensors (supply volts, battery volts and temperature) can now just be selected as a source for any sensor. NOTE: The sensor sources have been significantly changed. See below.
Digital I/O	DIO1 and DIO2 fixed as digital inputs. DIO3 and DIO4 fixed as outputs (DO1 and DO2).	All four channels can be configured as in or out. However, only DI1 and DI2 inputs can be used for high speed (frequency) inputs. Enable flag removed. Mode=0 is now “Disabled”. Extra mode added (Schedule Plus) with sensor or comms power control, also activated while user is logged in for calibration. Mode to trigger from set points on Sensor 1 removed. These can be done more flexibly via a script if required. Modes have been totally reordered.
Analogue Output	Fixed full scale output. Typically 5V excitation, actual signal is selected by hardware link.	Configurable. Either fixed value or set to follow a sensor’s current EU or last logged value. Actual signal is selected by a hardware jumper.
Sensor source changes		Extra digital input (3&4) sources added for pulse and auto-pulse. New floating-point loc also added. Battery volts = 22 Supply Volts = 23 Temperature = 24 RSSI shifted up list. Is now 25.
Sensor Rejection	Single set point. Can only reject above or below. No indication of value rejection.	High and low rejection limits. Will reject outside a defined band. Also, the LCD and terminal show if the current value is being rejected.
Sensor Alarms	2 per sensor	6 per sensor
Internal temperature measurement	Both ºC and ºF calculated in firmware and user selectable.	Always ºC, but when used as a sensor source, can be rescaled to ºF using multiplier and offset.

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Associated sensor Ids (added to the basic sensor id)	Min: + 10 Max + 20 Std Dev: + 30 Flow//Volume +40	Min: + 20 Max + 40 Std Dev: + 60 Flow//Volume + 80
Lookup Table Support	No	Yes – one table. Max 320 pairs. Fixed to use Sensor 1 as the derivation source.
Max Unload Block Size	200 words	500 words
iRIS-CAM Image Id	63/0	127/0
Firmware Id (Model)	Vk	Vx
Program File Suffix	.irs	.irx

Table 2 - iRIS 350 / iRIS 350X Differences

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3 Installation

3.1 Opening / Closing the Housing

The front of the iRIS enclosure is secured by four M4 machine screws with Phillips® heads.

There are two small plastic hinges on the case. These are designed to hold the lid once it is released.

To Open: Lift off the two grey plastic side covers to expose the screws securing the cover. Put them in a safe place. Undo all four screws. There is no need to remove them completely as they are retained in the lid. The front cover should then be able to be swung open, to a maximum angle of 90°.

To Close: Check that the black sealing strip is fully installed in its retaining groove and there are no wires likely to be trapped under the cover. Gently swing the front cover closed, holding it straight while refitting the screws. Tighten screws securely to maintain the IP66 rating of the enclosure. Replace the grey plastic side covers. Finally ensure the black rubber sealing cap is refitted to protect the RS232 connector.

3.2 Removing / fitting the SIM card

Important! Ensure the iRIS is depowered before attempting to remove or fit the SIM card. Exercise care when inserting or removing the SIM card, as the carrier is fragile.

Open the front cover as described above.

Using a finger nail or small screwdriver inserted into one of the two oval holes on the sliding holder, gently lower the slide downwards to unlock it. The slide can now be swung forwards from its top end to enable the SIM card to be inserted or removed. Reverse the procedure to close and lock the card into place.

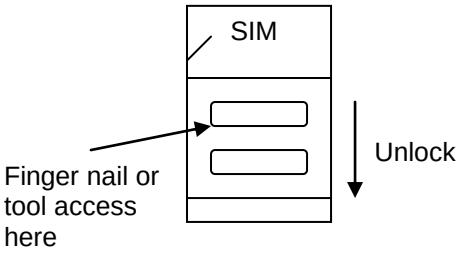

Figure 1 - SIM Carrier

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3.3 I/O Connector

All I/O and power supply terminations are via 5mm (0.2”) pitch screw terminals provided on a 16-way pluggable connector. The I/O connector is positioned on the right hand side of the iRIS circuit board, directly above the white battery connector.

The function of each I/O termination is shown in the diagram below.

iRIS 350X units fitted with a PCB revision V1.2+ have an 18-way connector compared to the 16-way connector on earlier units. The two additional terminals provide an extra GND connection and the 1-wire bus expansion port. They are shown as shaded in the diagram below.

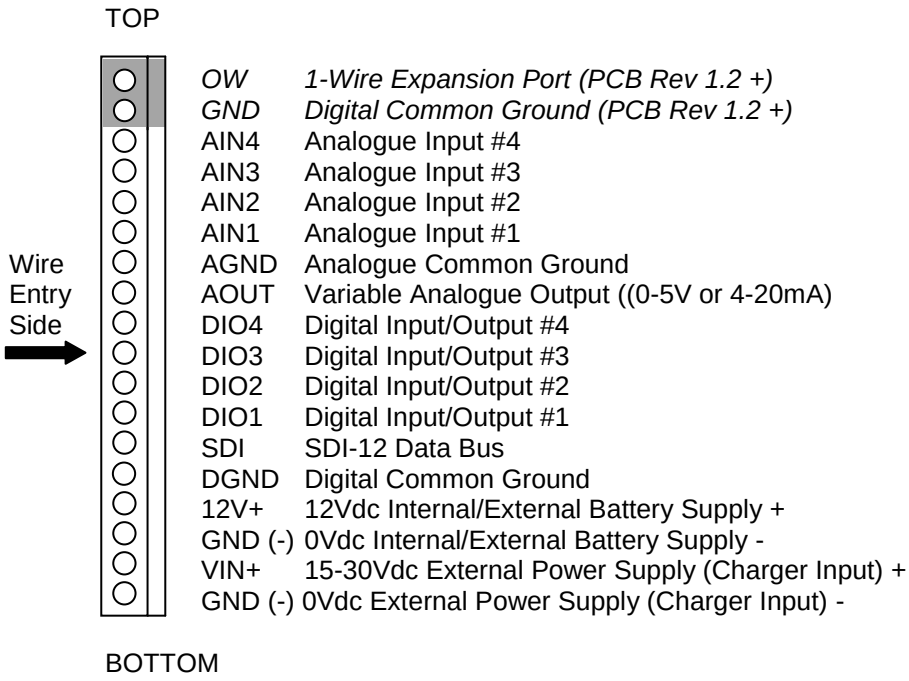

Figure 2 - I/O Connector

3.3.1 Internal Battery

The iRIS is supplied with an internal rechargeable 12V 0.8A/Hr sealed lead-acid battery. Upon installation, you will need to connect this battery as it is shipped disconnected to preserve battery life. It should also be disconnected if the unit is not going to be used for some time.

For maximum flexibility, the iRIS I/O connector has two terminals provided for additional 12V power supply flexibility. These terminals (marked 12V+ and GND) can either be used to deliver 12V from the internal battery out to power an external sensor or other small load, or alternatively be connected to an external 12V battery (for greater battery capacity) or a 12Vdc battery charger type power supply. See the next two sections on using the 12V terminals and the external (charger) power supply feature.

WARNING! INTERNAL BATTERY

The 12V+ and GND terminals of the I/O connector are effectively connected directly in parallel with the internal 12V battery. A resettable semiconductor fuse is fitted for short-circuit protection.

However, only connect 12V lead-acid batteries or a regulated d.c power supply that is designed for charging a 12V lead-acid battery, to these terminals.

Applying a voltage higher than 14.5V for a sustained period to these terminals will permanently damage the internal battery and may cause an acid leak and/or an explosion.

3.3.2 Internal / External 12V Battery Supply

There are two terminals provided on the I/O connector designated +12V and GND. These can be used to power the unit from an external 12V battery or regulated dc supply. The internal battery is effectively connected directly to these terminals. See Section 3.3.1 above for warnings on connecting external power supplies to them.

3.3.3 External (Charger) Power Supply

Although the iRIS can operate solely from the internal battery for a few days if set to full power save mode, you will typically need to connect an external supply to the unit so that the internal battery remains in a charged state. You can connect any external dc power source ranging from 15 – 30Vdc, including a solar panel, without requiring an additional solar regulator.

The battery charging circuitry utilises a switch mode regulator for maximum efficiency. The external power supply is protected against over-voltage by ultra-fast acting protection devices and a self-resetting semiconductor fuse.

It can also be used to charge an external battery connected to the GND and 12V+ terminals. In the event that the external battery draws excessive current, the charger will enter a current limit mode (900mA) until such time as the battery has been recharged sufficiently to deliver the full supply voltage. The charging profile used by the charger depends on the selected mode. See the Power Management description in Section 4.4.1.

The battery charger operates in a simple dual mode "float" / "charge" pattern. To do this it regularly switches between two voltage levels to optimise the battery charge. The actual profile is determined by the Power Source setting.

When the Power Source is set to "DC", the battery voltage will rise and fall every two hours giving a "sawtooth" type voltage plot when the data is logged. This is normal.

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3.3.4 Analogue I/O

Analogue Inputs

The four analogue inputs are uni-polar 0-5Vdc with 16-bit resolution. Each input presents a load impedance of 97KΩ to the input signal.

Scaling factors should be chosen to convert from a raw value of 0.0000 – 5.0000, which reflects the input signal range of 0-5V. When current sources such as 0-20mA or 4-20mA are connected, an internal sink resistor (100Ω) is enabled by an internal user-settable link (J1-J4). In this mode the measured voltage range is 0-2V for a 0-20mA input and the scaling factor should take this into account.

As the analogue inputs have an input impedance of 97KΩ, the actual sink resistor impedance will be slightly lower than the value fitted. When, for example, the current mode link is fitted, a sink resistor of 100 ohms is installed. The actual impedance will theoretically be 99.71Ω; therefore the voltage measured by the iRIS will also be slightly lower than expected. See Section 8 for details on the recommended scaling method for optimising the calibration.

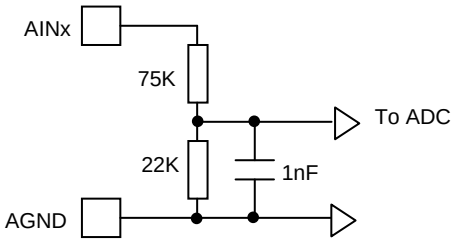

Figure 3 - Simplified Analogue Input Circuit

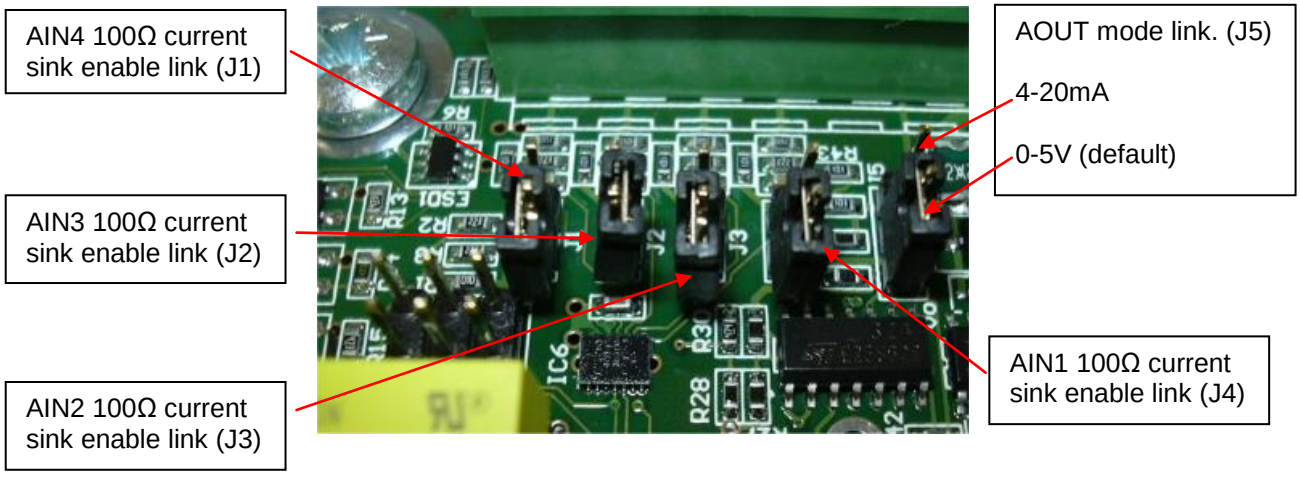

Figure 4 - Analogue Input / Output Links

Analogue Output

The iRIS has a single variable analogue output. This may be configured to deliver either a voltage output ranging between 0-5V or a current output ranging from 0-20mA or 4-20mA. The output's electrical signal (voltage or current) is link selectable.

See Section 4.4.16 for details on configuring the analogue output.

3.3.5 Digital I/O

The iRIS has four digital I/O channels which can each be configured as either an input or output. When set as an output, the channel can either supply switched 12V or else act as a pull-down switch for loads with a different supply voltage. If the digital output configuration is set to 0 (Disabled) the channel is by default an input. See Section 4.4.15 for details on configuring the digital outputs

Digital Channels as Inputs

The digital inputs are selectable for either mechanical or electronic operation. In either case it is necessary to pull the input down to 0Vdc to activate it. Inputs will handle up to 30Vdc in the off state for parallel connection across existing equipment. The "debounce" is enabled by a jumper link, which if fitted enables a longer time constant circuit to eliminate multiple pulses caused by contact bounce. The debounce jumpers are positioned in the centre of the PCB. The picture below shows the links in their default positions.

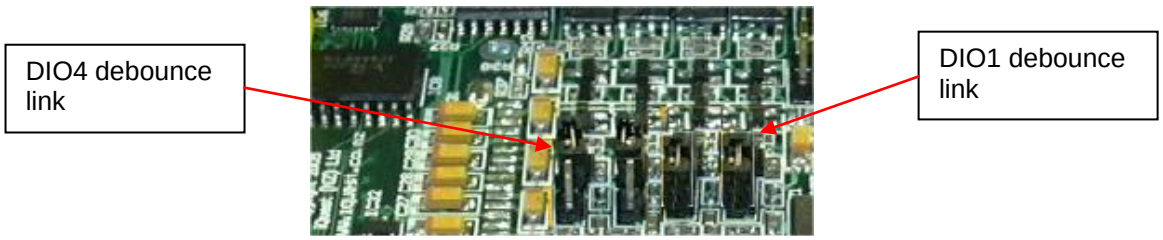

Figure 5 - Digital Input Debounce Links

Fit the jumper for mechanical switching at up to 20Hz. In this mode the input is normally pulled up to 12V through a 10KΩ resistor providing a wetting current of approximately 1.2mA. A 100nF capacitor is also fitted across the input to provide limited hardware debounce, preventing false triggering due to contact bounce. For installations that do not have an external power source it is important that the input is not held low for a prolonged period of time, as this will increase the current drawn from the internal battery.

Remove the appropriate jumper for electronic switching at up to 5kHz (on DIO1 and DIO2 only). In this mode the input is normally pulled up to 5V through a 57KΩ resistance, providing a wetting current of approximately 100μA.

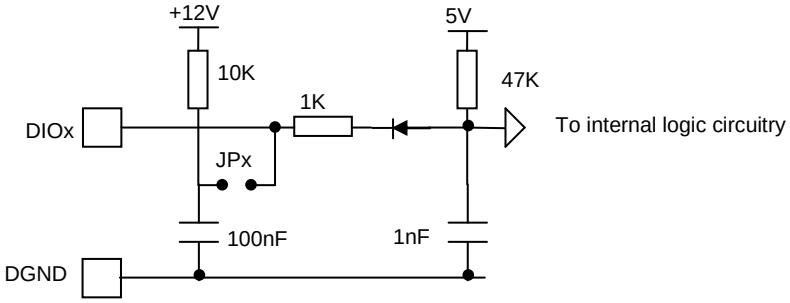

Figure 6 - Digital Input Circuit

IMPORTANT NOTE!

In almost all installations where an iRIS is connected in parallel with other equipment to share a common pulse input (e.g. from a flow meter), there has not been a detrimental effect, as the iRIS inputs present a relatively high impedance to the circuit. However, in the event that connecting an iRIS does cause pulse failure, iQuest recommend removing the debounce selection link for the appropriate input. This sets the input to electronic switching mode, even if the actual pulse source is a clean contact (reed switch or similar).

The debounce jumpers are located in the centre of the PCB and can be accessed once the front cover is opened. See Figure 5 above.

Hint: When removing a jumper, simply fit it to one pin only of the connector to avoid it being lost.

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Digital Outputs

When an iRIS digital I/O channel is configured as an output it can be operated electrically in one of two ways. Either:

Open-drain pull-down which is capable of sinking up to 100mA at 30Vdc. An integral diode provides transient protection. Typically this output mode can be used to drive a relay or lamp powered by an auxiliary d.c supply (e.g. 12V). In this mode, the negative of the load supply must be connected to one of the iRIS GND terminals.

Although it may appear possible to directly control sensors by switching the sensor negative supply lead using a digital output, this will introduce measurement errors and may possibly damage the sensor. Always use a digital output configured as a switched 12V output to power sensors.

Or:

Switched 12V output which is capable of sourcing up to 100mA. Typically this output mode will be used to drive a sensor, relay or lamp powered by the iRIS's 12V supply.

Care should be taken to avoid the load discharging the internal and/or external 12V battery. Ensure adequate power supply charging capacity is available to cater for the demands of both the logger and load.

The digital outputs may also be programmed to follow the state of the IP connection so that they will be active when a wireless IP session has been established. This mode can be used to control power to an external data radio when using the iRIS as a radio based gateway.

Typically, an output is configured to follow a schedule for use in powering loads. There is a similar mode termed "Schedule Plus".

In "Schedule Plus"mode, the relevant output(s) will be activated when a user is logged on to allow sensor calibration or radio communication testing. It will also activate when a call-in is pending and the Power Save mode is set to RS232 Telemetry to allow communications equipment to be powered up

Alternatively they can be selected for remote control directly from a HydroTel™ base station, activation if any alarm is active in the iRIS or to operate in response to absolute set points against the current sensor value on Sensor #1 for applications such as triggering sediment samplers.

See Section 4.4.15 for details on the digital output modes.

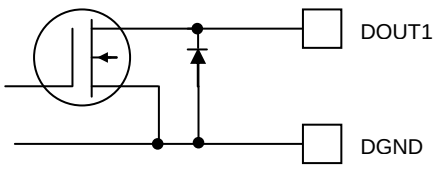

Figure 7 - Pull-Down Mode Circuit

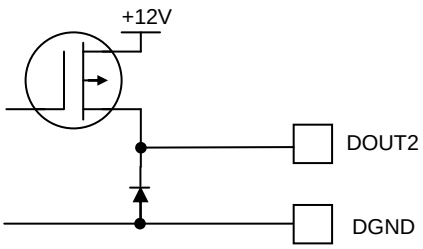

Figure 8 - Switched 12V Mode Circuit

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4 Configuration

The iRIS configuration is achieved through the connection of a terminal to the RS232 serial port.

Upon detection of a terminal connection when the RS232's port DSR signal becomes active, the iRIS will output the main configuration menu to the terminal screen. The following sections describe how to set up a terminal connection and all the menu options that are available while connected.

The description assumes a computer running the Microsoft® Windows® operating system is being used and all examples relate to the legacy Windows® terminal emulator application, HyperTerminal™ which was provided as standard in versions prior to Windows Vista®.

iQuest provides "iLink", which is a support utility for configuring the iQuest range of dataloggers. This includes a terminal emulator that is similar in function to HyperTerminal®. iLink is available from the iQuest website.

4.1 Terminal Connection

The iRIS RS232 port is a DTE (Data Terminal Equipment) configured port and is identical in pin-out and signal allocation to that of an IBM compatible PC's RS232 port. Therefore the cable required is the same as that for computer-to-computer communication and is termed a ***null-modem*** cable. These are available from most electronics retailers if required.

To access the iRIS configuration terminal session, connect a full null-modem cable (wired as shown below) between a communication port (e.g. COM1) on your computer and the RS232 port of the iRIS. The null modem cable configuration has the three main signal pairs crossed over. These pairs are TXD/RXD, RTS/CTS and DTR/DSR. The signal ground (SG) line is connected straight through. The CD and RI lines are unused.

Computer DB9F			iRIS DB9F	
1	CD		CD	1
2	RXD	———	TXD	3
3	TXD	———	RXD	2
4	DTR	———	DSR	6
5	SG	———	SG	5
6	DSR	———	DTR	4
7	RTS	———	CTS	8
8	CTS	———	RTS	7
9	RI		RI	9

Figure 9 - RS232 Cable Pin Designations

4.2 Terminal Security Code

The iRIS supports the use of a text-based security code (of up to 10 characters) that may be used to prevent unauthorised access to the terminal menus.

If used, the code is set using iLink that is registered to "Administrator" level. If it is empty, the terminal is immediately available as soon as the RS232 connection is made. If the code has been set, then a prompt message is shown and the code must be entered before the terminal becomes available.

The security code is case-sensitive. The code cannot be viewed or changed except by an authorised user using iLink which is registered to Administrator level.

> Enter Security Code (max 10)=

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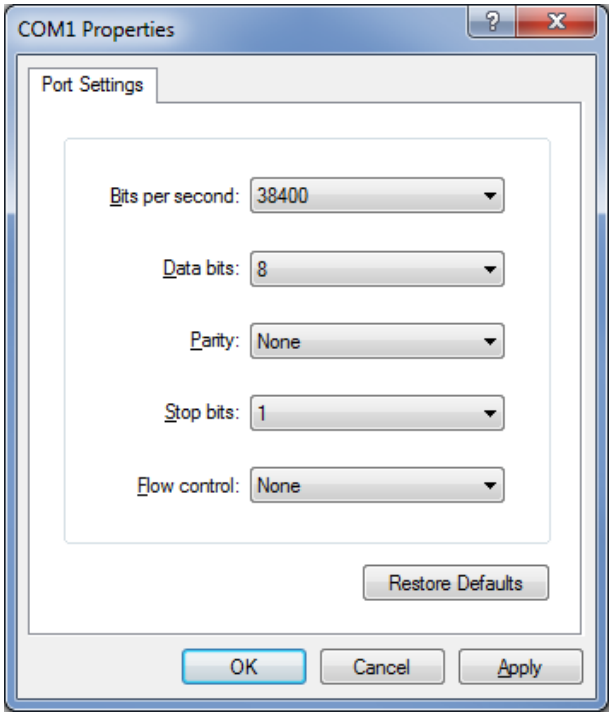
4.3 Terminal Cfg

Start Windows® HyperTerminal™ and create a new connection called “iRIS”. Set your terminal properties as shown in the dialog boxes below.

If you have connected the iRIS to any port other than COM1, make an appropriate selection from the drop down combo box.



The iRIS RS232 serial port is set by default to a speed of 38400 bps, 8 data bits, 1 stop bit and no parity. Flow control is not required.

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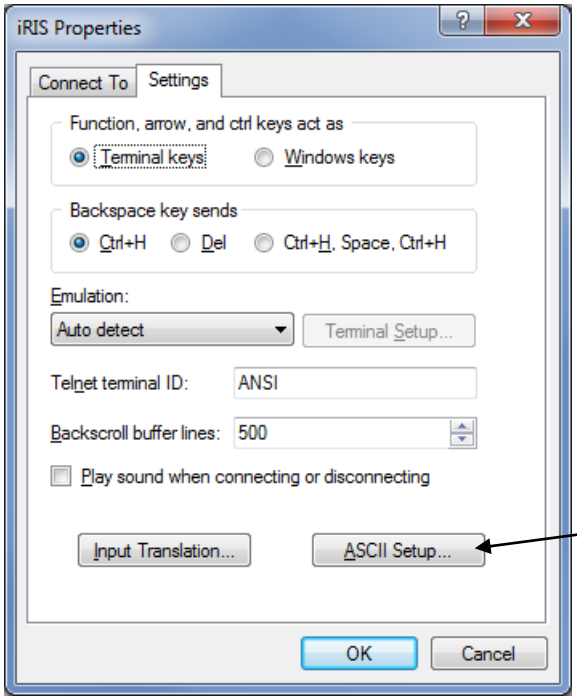
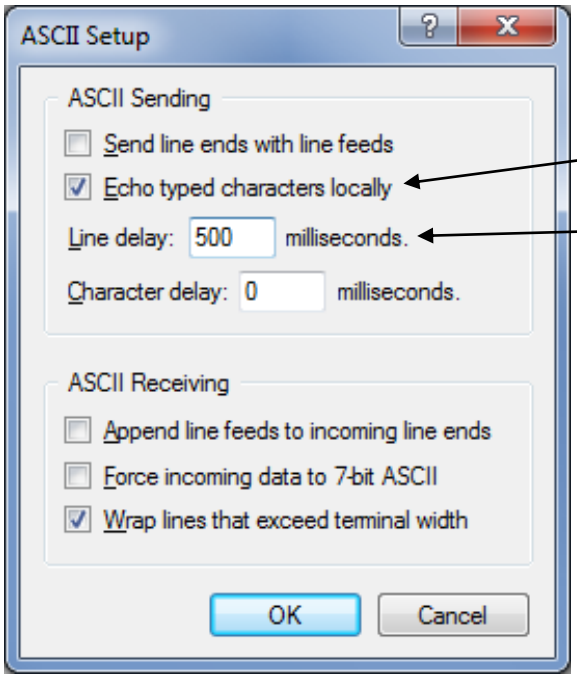


Click this for ASCII setup



Enable echo

Set line pacing delay

Because the iRIS does not echo received characters, it is necessary to enable **"Echo typed characters locally"** otherwise you will not see the characters that you type in at the terminal.

Also, set the **"Line delay"** time to 500ms for pacing the input from text files if this method is used for setting up a unit from a common template.

For configuring the sensors it is recommended that the iRIS sensor configuration tool in iLink is used. This tool enables common sensor configurations to be saved / loaded from disk and also sent or retrieved by any communication method that the logger supports.

See Section 7 for details on using the integrated sensor tool in iLink.

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4.4 Terminal Menus

4.4.1 Main Menu (Level 1)

Throughout all the terminal menus, there are two common entry codes.

- Menu option 0 (zero) always returns you to the level above your current position.
- Entering “r” or “R” when in a menu being prompted for an option will refresh the menu without selecting anything. This can be useful over a UDP terminal session where it is possible a packet may be lost and you are unsure which menu is currently selected.

When a terminal session has been established with the iRIS through the RS232 port or UDP socket A, you will be presented with the main menu. To make a menu selection, type a number followed by <Enter>. Invalid menu selections will result in the display of an error message on the terminal. The current value of each settable item is enclosed in square braces e.g. [1234].

Level1	***Level2***	***Level3***	***Level4***	***Level5***
Main Menu				
	Comms Cfg			
		Modem Cfg		
			IP Acceptance Cfg	
			Schedule Cfg	
			Network Info	
		RS232 Configuration		
		Phone List		
	Sensor Selection			
		Sensor Cfg		
			Alarm Selection	
				Alarm Cfg
	Output Selection			
		Output Cfg		
	Date/Time Cfg			
	Miscellaneous			
	[Voice] or [Camera] (options)			

Figure 10 - Terminal Menu Structure

All configuration examples shown in the following sections are for an iRIS350XV.

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4.4.2 Main Menu (Level 1)

The first menu displayed is the Main Menu. From here, you can make the following choices:

```
* iRIS 350XV Cellular(W) (AG1-0000, F1.30, S1.30, O1.04)
1 Site Name [My Site Name]
2 Power [Full Save, Solar]
3 Comms
4 Sensors
5 Outputs
6 Date/Time [20 Apr 2011, 12:37:55, UTC +12hrs]
7 PIN Code [0001]
8 Miscellaneous
9 Voice
>
```

Option 1 - Site Name
Select this option to enter a name for the site that will be displayed on the main title screen of the LCD. The maximum length of the site name is fixed at 19 characters. On the iRIS 320 this is 12 characters.

Option 2 - Power
When this option is selected you will be prompted to enter a number representing the power saving mode required.

```
> Power Save (0:None 1:Partial 2:Full 3:RS232 only)=
```

Once the power save mode has been entered, you will then be prompted to enter the power source for the charger (0 for fixed dc power supply or 1 for solar). This selects the battery charging profile the iRIS will use.

```
> Power Source (0:DC 1:Solar)=
```

Check the features section (Section 2.3.4) of this manual to learn more about the various power saving modes available.

Option 3 - Comms
Select this option to display the Comms configuration menu.

Option 4 - Sensors
Select this option to display the Sensor configuration menu.

Option 5 - Outputs
Select this option to display the Digital Output configuration menu.

Option 6 – Date/Time
Select this option to display the Date/Time and clock configuration menu.

Option 7- PIN Code
When this option is selected you will be prompted to enter a security PIN code between 0 and 9999. This PIN code is used to restrict access to specific LCD screens. If the PIN code is set to 0 (factory default) then only the four status and the totaliser (view only) LCD screens are accessible.

```
> PIN Code=
```

Option 8 - Miscellaneous
Select this option to display the Miscellaneous configuration menu.

Option 9 – Voice or Camera
The Voice option is only available on the iRIS 350XV variant that is equipped for voice operation.
Select it to access the Voice configuration. See Appendix C – Voice Annunciation (iRIS 350XV)

The Camera option is only available if the appropriate software variant is installed.
Select it to access the Camera configuration menu. See Appendix D - Using an iRIS-CAM Camera

4.4.3 Comms Cfg (Level 2)

The comms configuration menu is the starting point for configuring all iRIS communication settings:

```
* Comms Cfg
0 Exit
1 Address [10812] [AG4-0812 +10000]
2 Base Type [HydroTel]
3 Modem Cfg
4 RS232 Cfg [38400 bps, Base 0, Gateway Disabled]
5 Phone List
6 Connection [0:IP, 0:TCP]
7 Modem Terminal
8 SDI-12 Terminal
>
```

Option 0 - Exit
Select this option to return to the Main Menu.

Option 1 - Address
When this option is selected you will be prompted to enter the iQuest protocol communication address for the device. The first choice is whether the address should be obtained automatically from the device's serial number.

```
> Use Serial Num as Address. Enable (0:No 1:Yes)=
```

If this mode is enabled, then an optional offset can now be entered. Using offsets can be used to categorise units into regions for example.

The serial number plus the offset must still result in an address within the allowable range of 1-32767.

```
> Address Offset=
```

If the automatic serial number mode is not enabled, the menu will go direct to the manual address input prompt.

```
> Address=
```

When using a manual address, enter a value between 1 and 32767 (the factory default is 1). This address is used to identify the unit in all iQuest protocol communication and must be unique on a HydroTel™ communications interface.

An address of 0 is reserved for the base station (e.g. HydroTel™) and must not be programmed into the iRIS. The iRIS will always respond to an address of -3 (which is a special universal address) no matter what its own address is.

Option 3
This option selects the type of base station to which the iRIS will be connected.

```
> Type (0:HydroTel 1:Other)=
```

If you are connecting to a HydroTel™ base station (including the iQuest Global Data Network), set this value to 0 (HydroTel), otherwise set it to 1 (Other) for other host systems such as the iQuest iRIS Web Agent that accept auto-reported data. This option affects the format of unsolicited messages sent to the base station.

Option 4
Select this option to enter the Modem Configuration menu.

Option 5

This option allows you to configure the RS232 port parameters. This menu is a chained input which means it prompts for multiple entries one after the other before returning to the communication menu.

These settings only apply when the iRIS has its Power Save mode set to "RS232 Only" and it is actually in Telemetry mode. Otherwise the RS232 port operates normally at 38400bps.

The first RS232 port setting field is the speed in bits per second.

```
> RS232 Speed (0:1200,1:2400,2:4800,3:9600,4:19200,5:38400bps)=
```

The second parameter is the address of the base station to use when calling back using the RS232 telemetry mode. The base address is normally set to zero.

```
> Base Address=
```

If the unit will be expected to call back to HydroTel via a gateway site elsewhere, the base address will need to be set to a suitable value (normally the gateway setting in the gateway logger). If the base address is left set to zero in this situation, call-backs will fail.

Finally, the third entry field is for the RS232 gateway offset. Use 0 to disable gateway communication. If this is not zero, then a gateway block of 100 locations is set up starting from the offset. E.g. If the gateway offset was set to 3000 then any address between 3000 and 3099 inclusive would be retransmitted back out the RS232 port with aliasing applied.

```
> Gateway Offset=
```

The RS232 Only gateway mode is different to the wireless IP to RS232 bridge mode that requires a special cable to invoke. See Section 9, RS232 Interface Telemetry / Gateway Comms for more detail on using gateway communication.

Option 6

Select this option to enter the Phone List menu. This menu enables the entering of up to two phone numbers to use as destinations for SMS text messages.

Option 7

This option prompts you to enter a number representing the call-back mode for the wireless modem. This is the mode to use when the iRIS notifies an alarm notification or a test call is initiated from the keypad.

```
> Mode (0:IP, 1:SMS)=
```

If mode 0 (IP) is selected, a second option will then be available to select between TCP or UDP protocols.

```
> Protocol (0:TCP, 1:UDP)=
```

Option 8

By using this terminal mode, it is possible to perform two distinct functions depending on the state of the internal modem. If the terminal is available, this message is displayed.

```
> Terminal Mode active. Press <ESC> and then <Enter> to exit.
```

If the internal modem is powered down, the terminal mode is unavailable and this message will appear:

```
> Wireless module inactive. Terminal unavailable.
```

Assuming the modem is active, the two scenarios are as follows:

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- If the internal modem is powered up, but an IP session is not in progress, then it is possible to interact with the modem using the standard AT command set.

- If the internal modem is powered up and an IP session is currently in progress, then it is possible to interact with a terminal at the remote end of the connection.

When using transparent terminal mode you must press the <Enter> key after each command or message you wish to send. Press <ESC> followed by <Enter> to exit the modem terminal session and return to the communication menu.

Option 9
The SDI-12 terminal mode allows direct access to instruments connected to the SDI-12 interface. This is useful when a manual check or changes need to be made, such as address changes, scale factors etc. Knowledge of SDI-12 commands is required to make best use of this feature.

```
> SDI-12 Terminal mode active.  Press <ESC Enter> to exit
```

This menu option will only appear if one or more sensors have a source set to 19 (SDI-12).

4.4.4 Modem Cfg (Level 3)

The modem configuration menu is for defining the specific wireless IP connection parameters.

```
*  Modem Cfg
0  Exit
1  APN  [iquest.co.nz]
2  LogIn [,]
3 SIM PIN [0]
4 Dual Base [No]
5  Primary Base [192.168.1.10,7777]
6  Secondary Base [192.168.1.10,7777]
7  IP Acceptance
8  Schedule
9 Module Diagnostics
>
```

Option 0
Select this option to return to the Comms Cfg menu.

Option 1
When this option is selected you will be prompted to enter an APN (Access Point Name).

```
> APN=
```

Enter the name of the APN allocated by your network provider (e.g. iquest.co.nz).

Option 2
This option is where the network login parameters (user name and password) are configured. When this option is selected you will be prompted firstly to enter a user name, then a password. Many providers do not require any login credentials, in which case these parameters should be set to empty. ***Press <Esc> followed by <Enter> to enter an empty string.***

```
> User Name=
```

Enter the user name required by your wireless network provider.

```
> Password=
```

Enter the password required by your wireless network provider.

Option 3
When the SIM card installed has a PIN code enabled for security purposes, use this option to define it. If a PIN code is not required, enter zero (0) for this setting.

If a SIM PIN is required and an incorrect PIN is entered, the unit will not operate correctly.

Also, if the SIM PIN is set incorrectly, repeated attempts by the iRIS to log-on may result in the SIM card becoming locked out. This situation will require knowledge of the SIM's PIN Unlock Key (PUK) and/or contacting the SIM provider for unlock details.

Option 4
When this mode is enabled and the secondary IP settings are configured, the iRIS will make a connection to both bases in sequence for each connection event (scheduler or manually triggered).

Option 5
When this option is selected you will be prompted to enter an IP address and then a UDP or TCP port to use for the primary base.

```
> Primary Base IP=
```

Enter the remote IP address you want to have the iRIS connect to as its primary base (host server). Next, you will be prompted to enter a port number to use for the IP socket .

```
> Primary Base Port=
```

Enter a non-zero port number.

Option 6
When this option is selected you will be prompted to enter an IP address and then a UDP or TCP port to use for the optional secondary base.
This should be set to the same address as the primary base if there is only a single base.

```
> Secondary Base IP=
```

Enter the remote IP address that you will connect to. Next, you will be prompted to enter a port number to use for the secondary base.

```
> Secondary Base Port=
```

Enter the remote port number for the optional secondary base.
This should be set to the same port as the primary base if there is only a single base.

Option 7
Select this option to display the UDP IP Acceptance set-up menu. This enables up to five additional IP addresses that will be accepted when in UDP mode. These addresses are not used in the listening TCP Server mode if it is enabled and connections will be accepted from any source. Security is provided by the enforcement of the security string in terminal mode for these connections. See Section 4.2.

Option 8
Select this option to display the Modem Schedule configuration menu.

Option 9
Select this option to display the current module identification parameters, status and signal strength. After listing the status information, this option then provides a running diagnostic log of communication with the wireless modem. Please see the next section 4.4.5 for more details on the diagnostics that are available in this menu option.

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4.4.5 Modem Diagnostics

Example Status Information:

```
Type: Wavecom
IMSI: 530011101843665
IMEI: 351919030019844
RSSI: -76 dBm,0
LIP:  0.0.0.0
```

IMSI: *International Mobile Subscriber Information*. This is obtained from the SIM card
IMEI: *International Mobile Equipment Identifier*. This is stored in the wireless module at the factory and uniquely identifies the hardware by manufacturer and serial number.
RSSI: This displays the *Received Signal Strength Indication* in units of dBm. This is useful for determining the strength of the signal. A value of 0 indicates that the RSSI value is not available.
The iRIS will not attempt to connect to the network if the RSSI is 0 or less than -113dBm.
LIP: The last local IP address that was allocated to the iRIS when it was last online.

Example diagnostic information. This will differ between units with either the earlier (Maxon module) or the later (Wavecom module).

The < character indicates data received from the modem and the > character indicates data sent to the modem.

The current communication state is shown with a preceding STATE: message that includes several additional diagnostic e.g. PM1 SR0 TC0 TE0 TM0 LC0 LS0 PB CT3600. These are:

- ***PM Actual Power Management level being used. 0=No Save, 1=Partial Save, 2 = Full Save.***
- ***SR Sync Request. (0 = clock in sync, 1=need clock sync from network)***
- ***TC Terminal Connected. Terminal is connected (but not necessarily enabled).***
- ***TE Terminal Enabled. Terminal is enabled and usable.***
- ***TM Transparent Mode. The iRIS is connected and is in transparent mode.***
- ***LC Link Control. Requested link control (to the modem module). (Wavecom only).***
- ***LS Link State. Actual link state (from modem module). (Wavecom only).***
- ***PB Current base (host) that is (or will be) connected. PB=Primary, SB=Secondary.***
- ***CT Connection Timer. Connection time remaining. Set to duration when not connected.***

Wavecom module diagnostics:

```
16:42:35   STATE: Ready 1 0 P
16:42:40   STATE: Ready PM1 SR0 TC0 TE0 TM0 LC0 LS0 PB CT3600
16:42:40 > AT+CSQ
16:42:40 < +CSQ: 13,0 [-76 dBm]
```


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4.4.6 Phone List (Level 3)

The Phone List menu is the place to configure your primary and secondary phone numbers for SMS text messaging initiated by the iRIS. These numbers are only applicable when the Call-back mode is set to 1 (SMS). See the description of the call-back mode, Option 6 in Section 4.4.3.

```
*  Phone List
0  Exit
1  Pri Phone No [+6421123456]
2  Sec Phone No [+6421555999]
>
```

Option 0
Select this option to return to the Comms Cfg menu.

Option 1
When this option is selected you will be prompted to enter the primary SMS phone number.

```
> Pri Phone No=
```

Enter the number of the main cell phone that will receive iRIS initiated text messages (SMS mode).

Option 2
When this option is selected you will be prompted to enter the secondary SMS phone number.

```
> Sec Phone No=
```

Enter the number of a second cell phone that will also receive iRIS initiated text messages (SMS mode).

4.4.7 IP Acceptance Cfg (Level 4)

The IP acceptance set-up menu is the place to configure the IP address acceptance list for UDP mode.

The iRIS will always respond to messages from the IP addresses programmed for primary and secondary base since these are the defaults used for unsolicited calls. If your unit is connected to the iQuest APN and you would like iQuest to have access to the device for maintenance and support purposes, enter the iQuest Host IP Address (192.168.1.10) into one of the table entries – the default place for this address is entry 5.

```
*  IP Acceptance Cfg
0  Exit
1  IP #1 [0.0.0.0]
...
5  IP #5 [0.0.0.0]
>
```

Option 0
Select this option to return to the Modem set-up menu.

Options 1 - 5
Select any of these options to enter the IP address of host #1 – host #5 respectively.

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4.4.8 IP Connection Schedule Cfg (Level 4)

The schedule configuration menu is provided to manage the wireless communication schedule. Normally this is used for wireless IP connections but can alternatively be used to send regular SMS messages to the phone number(s) in the Phone List. See Section 4.4.5 above.

```
*  Schedule Cfg
0 Exit
1 Duration [120sec]
2 Frequency (Normal)[360min]
3 Frequency (in Alarm) [60 min]
4 Start Time [0600]
5 End Time [1800]
6 Send when [0 samples]
7 Data Format [Samples only]
8 TCP Server Duration [5min]    or    8 Inhibit UDP Announcement [Yes]
>
```

Option 0
Select this option to return to the Comms Cfg menu.

Option 1
When this option is selected you will be prompted to enter the length of time in seconds that you want the iRIS to keep each wireless IP session active.

```
> Duration (sec)=
```

Enter a value of 0 if you want to maintain a continuous wireless IP session. This mode should only be used in applications where a static IP address has been issued for the unit.

Option 2
When this option is selected, you will be prompted to enter the length of time in minutes between each successive wireless IP session being established or an SMS message being sent - when there is no active alarm in the iRIS. See Option 3 to set the in alarm frequency.

```
> Frequency (Normal) (min)=
```

Option 3
When this option is selected, you will be prompted to enter the length of time in minutes between each successive wireless IP session being established or an SMS message being sent - when there are one or more active alarms in the iRIS. See Option 2 for the standard frequency setting which applies when the iRIS has no active alarms.

```
> Frequency (in Alarm) (min)=
```

Option 4
When this option is selected you will be prompted to enter a string representing the time at which the iRIS is allowed to start establishing wireless IP sessions or sending SMS messages.

This time is when the first session will be established or SMS message sent.

```
> Start Time (HHNN)=
```

Option 5
When this option is selected you will be prompted to enter a string representing the time after which the iRIS must stop establishing wireless IP sessions.

```
> Stop Time (HHNN)=
```


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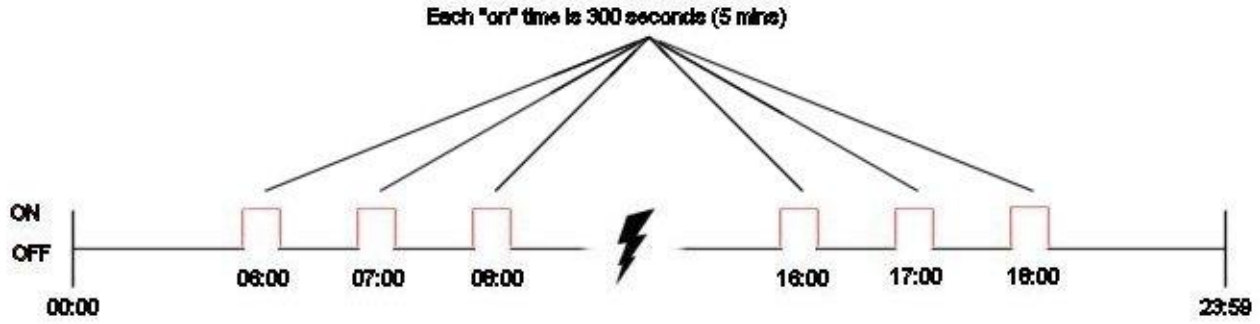
In this example, the wireless IP link is established once per hour (frequency = 60 minutes), for a time of 5 minutes (duration = 300 seconds) starting at 6:00am and ceasing after 6pm. Set the start time to 00:00 (0000) and end time to 23:59 (2359) for the on/off cycle to apply regularly throughout the complete day.



Option 6

The option allows an alternative trigger for automatic sending of data when the base type is set to “Other”. (See Option 3 of Section 4.4.3 for details on the Base Type). By setting a non-zero value, the iRIS will automatically connect and send its data when at least x samples have been logged. If this setting is zero, the schedule is the only method of triggering automatic data reporting.

```
> Send when x samples=
```

Option 7

When the base type is set to “Other”, this option defines the information that the automatically sent data packet will contain. By default, the data will only consist of logged data (value = 0), however it is possible to also have the iRIS time/date and/or pointers reported as well. Enter a value that is the sum of the options.

E.g. To send Samples, Logger Time and Pointers use a value of 3 (0+1+2).

```
> Data Format (+0:Samples only +1:Time +2:Ptrs)=
```

Option 8

This option has a different function depending on the IP protocol setting (TCP or UDP).

In TCP mode it defines the time (in minutes) that the iRIS will remain in a listening TCP Server mode after a TCP client session to the designated base station has been completed. Setting this parameter to zero will disable the listening TCP Server mode and the iRIS will return to idle mode immediately.

```
> Listening TCP Server (mins)=
```

In UDP mode it controls whether the iRIS will send an announcement packet to the base station (HydroTel) when the IP connection is established. Normally this is set to 0 (No) and HydroTel will initiate unloads of the iRIS each time it announces it is on-line. For installations where the iRIS is configured to be virtually on-line continually and polled by HydroTel, set this to 1 (Yes).

```
> Inhibit UDP Announcement (0: No, 1:Yes) =
```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4.4.9 Sensor Groups (Level 2)

Because the iRIS can support up 20 sensors, it is not possible to handle all these in a single digit menu structure. To solve this, an intermediate menu is provided to group the sensors into four sub-groups for further selection.

```
* Sensor Groups
0 Exit
1 Sensors 1-5
2 Sensors 6-10
3 Sensors 11-15
4 Sensors 16-20
>
```

Option 0
Select this option to return to the main menu.

Option 1-4
Select this option to display the sensor sub-selection group.

4.4.10 Sensor Selection (Level 3)

The Sensor Selection sub-menu shows a brief overview of the sensors by showing their source and name.

The configuration menu for the desired sensor can be selected from here by entering the appropriate number.

```
* Sensor Selection
0 Exit
1 S1 [ 1:Analog1]Water Lvl
2 S2 [ 5:Pulse1]Rainfall
3 S3 [22:Batt V]Battery
4 S4 [24:Temp]Temp
5 S5 [Dis]
>
```

4.4.11 Sensor Cfg (Level 4)

The Sensor Cfg menu is used to configure each of the twenty virtual sensors. Refer to the datalogging features (Section 2.3.5) of this document for a discussion on datalogging and virtual sensors. This menu option also shows the current scaled measurement value for the selected sensor.

Analogue sensors also display the actual measured voltage as shown in the example.

```
* Sensor 1 Cfg
(Now:     1.023 [ 1.0238 V])
0 Exit
1 Src [1: Analog1]
2 Name [Water Lvl]
3 Mode [Avg]
4 Mult [   1.00000]
5 Offset [     0.000]
6 Reject [L     0.000],[H     0.000]
7 Log Rate [15 min], Mult [1000]
8 Alarms
9 Data
>
```

Option 0
Select this option to return to the main Sensor Cfg menu.

Option 1
When this option is selected you will be prompted to enter a number representing the source from which the virtual sensor should acquire its data. Use zero to disable the sensor. Valid data sources are shown below.

```
> Source (0-26)=
```

Source	Description	Raw Range	Multiplier	Offset	Log Multiplier
0	Unused / disabled	N/A	N/A	N/A	N/A
1	Analogue Input 1	0 to 5.0000			
2	Analogue Input 2	0 to 5.0000			
3	Analogue Input 3	0 to 5.0000			
4	Analogue Input 4	0 to 5.0000			
5	Pulse Counter on Digital Input 1	0 to 1			
6	Pulse Counter on Digital Input 2	0 to 1			
7	Pulse Counter on Digital Input 1	0 to 1			
8	Pulse Counter on Digital Input 2	0 to 1			
9	Auto Pulse Counter on Digital Input 1	0 to 1			
10	Auto Pulse Counter on Digital Input 2	0 to 1			
11	Auto Pulse Counter on Digital Input 1	0 to 1			
12	Auto Pulse Counter on Digital Input 2	0 to 1			
13	Frequency Counter on Digital In 1	0 to 5000Hz			
14	Frequency Counter on Digital In 2	0 to 5000Hz			
15	Up/Down Counter on Digital Ins 1 & 2	-32768 to 32767			
16	High-speed Serial Instrument	-32768 to 32767			
17	Integer Database Location	-32768 to 32767			
18	Floating-Point Database Location		1		
19	SDI-12				
20	Quadrature Shaft encoder	-32768 to 32767			
21	DC power availability status	0 to 1	1	0	1
22	Battery Voltage		1	0	100
23	Supply Voltage		1	0	100
24	Internal Temperature		1	0	10
25	Received Signal Strength	-113 to 0 dBm	1	0	1
26	Derived (Lookup table from Sensor 1)				

Table 3 - Standard Sensor Sources

Option 2

When this option is selected you will be prompted to enter a name for the sensor (maximum 10 characters). This name will be displayed on the iRIS LCD sensor screens.

```
> Name (max 10)=
```


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Option 3
When this option is selected you will be prompted to enter a number representing the processing mode to apply to the measurements.

```
> Mode (0..4)=
```

Valid modes are:

Mode	Name	Description
0	Instant	Logs only the most recent sample
1	Full Period Average	Logs the average of all samples taken over the logging period
2	Event	(Only valid for pulse input sources) Logs only non-zero samples. If the logging rate is 0, then any pulse is logged immediately. If the logging rate is > 0, then the total accumulated in the period is logged only if it is not zero. In this mode, if there was no sample logged at the last expected log time, a zero sample is also logged, time stamped with last expected log time/date. This is required for some time series management purposes.
3	Scalar Average (for Wind Direction)	Logs the average of all samples taken over the logging period, but uses scalar calculations to calculate the average.
4	1 min Average	Logs the average of all samples taken over the one minute period prior to the data being logged. This is useful for sensors that are powered on a timed basis using a digital output and some averaging is still required. In this case, using the Full Period Average (1) would give an incorrect value.

After selecting the mode, you will then be prompted to configure the extended datalogging options by entering in a number that represents a set of option "flags".

```
> Flags (+1:Min +2:Max +4:Dev +8:Flow/Vol)=
```

The number entered is the sum of the extended logging options that you want to enable.
See the table on the next page for a listing of all the valid options.

Flag Value 1 = Log Minimum Value sampled in log period
Flag Value 2 = Log Maximum Value sampled in log period
Flag Value 4 = Log Standard Deviation of samples in log period
Flag Value 8 = Log calculated Flow Rate (in l/s) over log period (only pulse types, when source = 5 to12).
Or log Accumulated Volume for sensors with an analogue or frequency source.

Flag Value	Description
0	No additional logging
1	Log Minimum
2	Log Maximum
3	Log Minimum and Maximum
4	Log Standard Deviation
5	Log Minimum and Standard Deviation
6	Log Maximum and Standard Deviation
7	Log Minimum, Maximum and Standard Deviation
8	Log Flow Rate or Accumulated Volume
9	Log Minimum and Flow Rate or Accumulated Volume
10	Log Maximum and Flow Rate or Accumulated Volume
11	Log Minimum, Maximum and Flow Rate or Accumulated Volume
12	Log Standard Deviation and Flow Rate or Accumulated Volume
13	Log Minimum, Standard Deviation and Flow Rate or Accumulated Volume
14	Log Maximum, Standard Deviation and Flow Rate or Accumulated Volume
15	Log Minimum, Maximum, Standard Deviation and Flow Rate or Accumulated Volume

Table 4 - Supplementary Logging Flag Definitions

Option 4
When this option is selected you will be prompted to enter a scaling multiplier. This multiplier is used to convert the raw input into engineering units. It is the “m” variable in the *y=mx+c* scaling equation.

```
> Multiplier=
```

Option 5
When this option is selected you will be prompted to enter a scaling offset. This offset is added to the scaled engineering value. It is the “c” variable in the *y=mx+c* scaling equation.

```
> Offset=
```

Option 6
To prevent invalid measured values being used and possibly generating spikes, a rejection band can be configured. Any measured values that are outside the band will be ignored and the last "good" value retained. This may cause "flat-lining" of data if the measured value is continually out of range and care should be taken when using this function.

A typical example where this feature is most useful is an SDI-12 ultrasonic wind sensor that returns a 999 value for wind speed when a single measurement failed. This may only occur for a few seconds and all other values are valid. If the 999 error value is accepted and passed into the average, the value obtained for the complete log period value is compromised.

Setting both rejection values to zero will disable rejection.

```
> Reject Low (set both 0 for none)=

> Reject High=
```

Option 7
This option also has two parts:- the logging rate and logging multiplier.

When the option is first selected you will be prompted to enter a logging rate (in minutes) for the sensor.

```
> Log Rate=
```

If you wish to log digital data in true event (change of state) mode you can enter a value of 0 for this setting.

If this parameter is left set to 0 for any non-pulse type source, then it will not be logged.

Then enter a logging multiplier to convert from engineering units to an integer value for storage in the logging memory.

```
> Log Multiplier=
```

For example, if you need to log a measurement that has a resolution of two decimal places, you will need to enter a logging multiplier of 100.

IMPORTANT NOTE: Care needs to be taken in the selection of an appropriate logging multiplier because the iRIS stores data as signed 16-bit integer values (range from -32768 to 32767). This means that the maximum scaled value multiplied by the logging multiplier must not exceed 32767. If it does, the values will limit at that point and data will be lost.

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Option 8
Select this option to display the Alarm Configuration menu for the sensor.

Option 9
Select this information to view the logged data for the sensor. You will be prompted to enter the number of samples you would like returned. The output will appear as shown in this example. The date format used is configured in the Date Format menu option. See Section 4.4.16. The number of samples may be less than that requested if insufficient samples exist in the iRIS. Finally, the current logging EOD pointer is also shown.

```
Data Dump for Sensor 1 (Water Lvl)
17/04/2008,14:00:00,     2.177
17/04/2008,13:55:00,     2.168
17/04/2008,13:50:00,     2.159
17/04/2008,13:45:00,     2.155
17/04/2008,13:40:00,     2.148
5 sample(s) retrieved. EOD:   9584
```

This option is only available when the terminal session is through the RS232 port.

4.4.12 Alarm Selection (Level 4)

Use the Alarm Selection menu to decide which alarm you want to configure. You can see at a glance from this menu which alarms are enabled and to which sensor they belong.

```
*  Sensor 1 Alarm Selection
0  Exit
1  Alarm #1 (Enabled)
2  Alarm #2 (Disabled)
3  Alarm #3 (Disabled)
4  Alarm #4 (Disabled)
5  Alarm #5 (Disabled)
6  Alarm #6 (Disabled)
>
```

Option 0
Select this option to return to the Sensor Cfg menu.

Options 1-6
Select these options to view the set-up menu for Alarms 1-6 respectively.

4.4.13 Alarm Cfg (Level 5)

The alarm configuration menu is for defining settings for each of the sensor's alarms.

```
*  Sensor 1, Alarm 1 Cfg
0  Exit
1  Enable [Yes]
2  Trigger [   1.75]
3  Reset [   1.65]
4  Duration [0min]
>
```

Option 0
Select this option to return to the Alarm Selection menu.

Option 1
When this option is selected you will be prompted to enable/disable the alarm.

```
> Enable (0:No 1:Yes)=
```

Enter a value of 0 to disable the alarm. Enter a value of 1 to enable it.

Option 2
When this option is selected you will be prompted to enter a trigger level for the alarm.

```
> Trigger=
```

Enter a value in engineering units that you want to use as the trigger point for the alarm. When the scaled value crosses this limit the alarm will become active. The trigger direction is determined by the reset level. See Option 3 below.

Option 3
When this option is selected you will be prompted to enter a reset level for the alarm.

```
> Reset=
```

Enter a value in engineering units that you want to use as the reset point for the alarm. When the scaled value falls below this limit the alarm will be deactivated. If the reset level is set to a value greater than the trigger level then the alarm is reverse acting. This mode is normally used for low voltage or level alarms.

Option 4
When this option is selected you will be prompted to enter a time in seconds to delay alarm activation. This can be used to implement alarm hysteresis for analogue data sources that vary. If the data source is one of the internal counters, then this time is used to totalise individual sample values. If the total over the given alarm duration is above the trigger level then an alarm is generated. Typically this feature is used for rainfall alarms.

```
> Duration (min)=
```

4.4.14 Output Selection (Level 2)

The Output Selection menu is provided to configure the digital I/O channels as outputs. It also provides access to the analogue output configuration sub-menu.

From this menu, you can see at a glance which digital channels are enabled as outputs.

```
*  Output Selection
0  Exit
1  Output #1 (Enabled)
2  Output #2 (Disabled)
3  Output #3 (Disabled)
4  Output #4 (Disabled)
5  Analogue Out
>
```

Option 0
Select this option to return to the main menu.

Options 1-4
Select these options to display the set-up menu for Digital Channel DIO1-DIO4 respectively.

Option 5
Select this option to display the set-up menu for the Analogue Output.

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4.4.15 Digital Output Cfg (Level 3)

The Digital Output Cfg menu is used to configure each digital output. In the example below, Output 3 is being configured.

```
* Digital Output 3 Cfg
0 Exit
1 Mode [0: Disabled]
2 Polarity [Nml (Pull-Dn)]
3 Duration [0 sec]
4 Interval [0 min]
5 Start Time [0000]
6 End Time [0000]
>
```

Option 0
Exit. Select this option to return to the Output Selection menu.

Option 1
Mode. When this option is selected you will be prompted to enter a number representing the operating mode of the output.

```
> Mode (0..5)=
```

Valid digital output modes are:

Source	Description
0	Disabled. The Digital I/O channel will operate as a digital input.
1	Schedule. Follow the schedule as defined by the settings in Options 3-6 described below.
2	Schedule Plus. Follow the schedule as defined by the settings in Options 3-6 described below. Also activate the output when a user is logged in or an RS232 Telemetry mode call-in is in progress.
3	The output is on if **any** sensor alarm is active. Turns off when **all** alarms are inactive.
4	Remote Control from HydroTel or via a custom script. DIO1 is controlled by bit 0 of d1000, DIO2 by bit 1 of d1000, DIO3 by bit 2 of d1000 and DIO4 by bit 3 of d1000.
5	Follow wireless link state i.e. the output is on if the wireless modem is on-line.

Table 5 - Digital Output Modes

When the output is set to Mode 2 (Schedule Plus): If a user is logged on via the LCD/keypad interface OR the Power Save mode is set to 3 (RS232 Telemetry) and an alarm requiring transmission to a base station is pending, the output will be on.

Option 2

Polarity. When this option is selected you will be prompted to select the switching polarity of the output. This relates to the output's electrical state with respect to its logical on/off state. It also defines whether the output type is a pull-down (switch to GND) or pull-up (switch 12V). Please refer to Table 6 below.

- If the polarity setting is 0 or 2 (Normal), the output will be electrically on when the output logical state is on and be high impedance (open-circuit) when the output is logically off.
- If the polarity setting is 1 or 3 (Inverted), the output will be high impedance (open-circuit) when the output logical state is on and be electrically on when the output is logically off.
- If the polarity setting is 0 or 1 (Pull-Down), the output will short the output terminal to GND. A maximum of 100mA can be sunk in this mode from an external load.
- If the polarity setting is 2 or 3 (Pull-Up), the output will supply 12V to an external load at up to 100mA.

```
> Polarity (0:PD-Nml 1:PD-Inv 2:PU-Nml 3: PU-Inv)=
```

Polarity	Name	Output Logical State	Indication LED	Output Electrical State
0	Normal Pull-Down	Off	Off	Open-circuit (Input)
		On	On	Pulled down to 0V (GND)
1	Inverted Pull-Down	Off	Off	Pulled down to 0V (GND)
		On	On	Open-circuit (Input)
2	Normal Pull-Up	Off	Off	Open-circuit (Input)
		On	On	Pulled up to +12V
3	Inverted Pull-Up In	Off	Off	Pulled up to +12V
		On	On	Open-circuit (Input)

Table 6 - Digital Output Polarity

Option 3

When this option is selected you will be prompted to enter the length of time in seconds that you want the iRIS to keep the output energised for if the mode is set to 1 (Schedule) or 2 (Schedule Plus).

```
> Duration (sec)=
```

Option 4

When this option is selected you will be prompted to enter the length of time in minutes between the successive operations of the output if the mode is set to 1 (Schedule).

```
> Frequency (min)=
```

Option 5

When this option is selected you will be prompted to enter a string representing the time at which the iRIS is allowed to start controlling the output if the mode is set to 1 (Schedule).

```
> Start Time (HHNN)=
```

Option 6

When this option is selected you will be prompted to enter a string representing the time at which the iRIS must stop controlling the output if the mode is set to 1 (Schedule).

```
> End Time (HHNN)=
```

See Section 4.4.8 IP Connection Schedule Cfg for details on how these parameters configure the schedule operation.

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Typical Scheduled Output Example

A ground water site using an iRIS is required to log a sample every hour that is obtained from a pressure transducer whose power supply is controlled from the digital output DIO4 which is configured as a switched 12V output. The transducer needs to be powered up for one minute prior to the measurement being taken and logged. The settings to achieve this are shown below.

```
* Digital Output 4 Cfg
0 Exit
1 Mode [1: Schedule]
2 Polarity [Nml (Pull-Up)]
3 Duration [65 sec]
4 Interval [60 min]
5 Start Time [0059]
6 End Time [2359]
>
```

The output will be activated at the beginning of the 59th minute of each hour in the day, starting at 00:59. It will remain on for 65 seconds, ensuring that the sensor is still powered up at the point when the reading is captured on the hour. The final output activation for the day will occur at 23:59 in preparation for the midnight measurement.

If some averaging is required, the one minute averaging (process mode 4) can be selected. However, set the scheduler to ensure that the sensor will be fully powered up before and throughout the one minute before logging.

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4.4.16 Analogue Output Cfg (Level 3)

The Analogue Output Cfg menu is used to configure the single analogue output.

```
* Analogue Output
0 Exit
1 Source [0: Fixed]
2 Mode [0: Current Val]
3 Zero [     0.000]
4 Span [   100.000]
>
```

Option 1
Source. This has two functions, based on the number entered:

0. This will configure the output to run in a fixed mode. The actual output voltage or current is defined by the Span setting as a percentage of full-scale (5V or 20mA). The example above will generate a fixed 5V output.

1-20. This sets the analogue output to use the measured value from one of the 20 sensors to generate the output. In this case the signal range is set by the Zero and Span settings which will be in the units of the sensors measurement..

```
> Source (0:Fixed 1-20:Sensor)=
```

Option 2
Mode. When the output is controlled by a sensor, this sets the actual value to use. Either the current value which will be updated regularly every time a measurement is taken. Or else use the last logged value which only changes when a processed value is logged. The mode is ignored when the source is Fixed (0).

```
> Mode (0:Current 1:Last Logged)=
```

Option 3
Zero. Sets the actual value representing the minimum signal output (0V or 0mA). The Zero setting is ignored when the source is Fixed (0).

```
> Zero Value=
```

Option 4
Span. Sets the actual value representing the maximum signal output (5V or 20mA). The Span setting is used to set the output as a percentage when the source is Fixed (0).

```
> Span Value=
```


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4.4.17 Date/Time Cfg (Level 2)

The Date/Time Cfg menu is where the various time functions are configured. These include date, time of day, date format, time zone offset and clock trim.

```
*  Date / Time 1 Cfg
0  Exit
1  Date [04 Apr 2011]
2  Time [14:23:49]
3  Date Format [0: dd Mmm yyyy]
4  Time Offset [UTC +12hrs]
5  Clock Trim [-1]
```

Option 1
When this option is selected you will be prompted to enter the current local date as a string containing four digits for year, two digits for month and two digits for day. ***All 8 digits must be entered.***

```
> Date (YYYYMMDD)=
```

Option 2
When this option is selected you will be prompted to enter the current local time as a string containing two digits for hour, two digits for minute and two digits for second. ***All 6 digits must be entered.***

```
> Time (HHMMSS)=
```

Option 3
When this option is selected you will be prompted to select the date format as used throughout the iRIS (LCD screens and terminal menus). Enter a number to select the desired format.

```
> Date Format
(0=dd Mth yyyy, 1=dd/mm/yyyy, 3=dd/mm/yy, 4=mm/dd/yyyy, 6=mm/dd/yy)=
```

Not all of the numbers between 0 and 6 relate to a valid format. E.g. 2 and 5. This is due to the way the iRIS uses the structure of the format code internally.

Option 4
When this option is selected you will be prompted to enter the offset of the iRIS' local time with respect to UTC (GMT). This is used for international time correction if the data is forwarded to the iQuest Global Data Network. For example, enter +12 for NZST or –8 for PST and so on.

```
> Time Offset=
```

Option 5
This option prompts for a number to trim the iRIS real time clock to minimise drift which can be dependent upon the average ambient temperature of the environment in which it is installed in extreme circumstances. This value can be between –3 and +3 and is a relative index that relates approximately to the number of seconds to correct per day. It is factory set to a default value of 0, providing minimal drift at typical room temperatures.

If the clock is slow (losing time), set the offset to be a positive value, or if it is fast (gaining time), set the offset to a negative value.

```
> Trim Factor (-3 to +3) =
```


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4.4.18 Miscellaneous Menu (Level 2)

This menu covers the miscellaneous configuration items.

```
*  Miscellaneous
0  Exit
1  Initialise
```

Option 1
This option is used to initialise the unit. This is generally done just after installation as part of the commissioning process to eliminate any test or residual data or totals. It resets the memory pointers to zero and also resets all totalisers. To ensure this task is not accidentally invoked, a specific string must be typed in order to execute the initialisation process.

```
> Type 'init' to initialise the unit
```

4.4.19 Voice Menu (Level 2)

This menu, only available on the iRIS 350XV, configures the voice annunciation feature.

```
* Voice Cfg
0 Exit
2 Sensors
>
```

Option 2
This list-based option enables which sensors will be included when a voice report is being played. Even though there are 20 sensors available, only sensors 1-9 can be assigned as voice capable.

```
* Sensor Voice Enable
0 Exit
1 Sen1 [Yes]
. . .
9 Sen9 [No]
>
```

Selecting any of the sensor numbers (1-9) will display a prompt for enable or disable voice reporting for the sensor. Enter 1 to include the chosen sensor in the voice report, or 0 to exclude it.

```
> Enable (0:No 1:Yes)=
```


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5 Operation

5.1 LED Indicators

The iRIS has several LED indicators. The main status LED and eight diagnostic LEDs are visible from the front of the enclosure.

5.1.1 Status LED

The status LED is a tri-colour device that is used to indicate the unit status.

Status	LED Indication
Idle, low or no signal strength	Flashes red once every three seconds
Idle, adequate signal strength	Flashes green once every three seconds
Connecting to network	Flashes blue every half a second
Connected to network	Flashes blue once every three seconds
Failed to connect	Flashes red every half a second

Table 7 - Status LED Indication Modes

5.1.2 Diagnostic LEDs

The iRIS has eight LED indicators that are useful for diagnostic purposes. These are visible through the front of the enclosure.

With the exception of the SDI-12 TX LED, these indicators are only active when the power management mode is set to No Power Save (see the Features Section 2.3.4 for details on power management).

DIO1 Illuminated red when Digital I/O #1 is active.

DIO2 Illuminated red when Digital I/O #2 is active.

DIO3 Illuminated red when Digital I/O #3 is active.

DIO4 Illuminated red when Digital I/O #4 is active.

RS232 RX Flashes green when data is received from the RS232 port.

RS232 TX Flashes green when data is transmitted out the RS232 port.

Modem Flashes green when there is receive or transmit activity to/from the wireless modem.

SDI-12 Flashes green when an SDI-12 message is transmitted or received.

5.2 LCD & Keypad

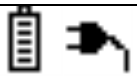
5.2.1 LCD Operation

The iRIS LCD is controlled to optimise power consumption. If the display has powered down (in full power save mode), the unit is in the lowest power mode and can be woken by pressing any key on the keypad.

After a certain period of no key presses, the display and backlight will power down again, although other functions continue normally. If the user was logged on (PIN entered), they will be logged off. This version of software has the timeout period set to 5 minutes.

5.2.2 Status Icons

At the top of the LCD is a row of status icons.

<table>
<tr>
<td> 
Indicates current connection state as given below:
▪ Invisible Disconnected
▪ Outline Disconnected in wireless mode
▪ Solid Connected in wireless mode
▪ Solid with ‘R’ Connected in RS232 only mode</td>
<td> 
Indicates active RS232 or IP terminal connection.
▪ Invisible No terminal connected
▪ Outline Terminal connected</td>
</tr>
<tr>
<td> 
Indicates transparent (modem or SDI-12) terminal mode is active
▪ Invisible no transparency
▪ Solid transparent terminal active</td>
<td> 
Indicates signal strength.
Only updated when wireless modem is powered up but wireless IP session is not active.</td>
</tr>
<tr>
<td> 
Flashes when an unsolicited call-in is pending or in progress. This can be the result of an alarm activation or a user request for a test call-in.</td>
<td> 
Indicates current battery charge. The level indication bars cycle when charging is in progress.

If the unit is on an external supply a power plug icon will appear.</td>
</tr>
<tr>
<td> 
Indicates current access level
▪ Invisible logged in
▪ Outline logged out
▪ Solid secure (PIN is set to zero)</td>
<td> 
These two icons are specific to the camera and voice versions respectively.
They will appear if a picture is being taken or a voice call is in progress.</td>
</tr>
</table>

5.2.3 Keypad Buttons

The four keypad buttons are used to navigate through the LCD screens. Their use varies depending upon the current screen in view; however the key combinations listed below are constant for all screens.

Alt +	Pan display right
Alt -	Pan display left

The display has been designed for a maximum of 24 characters per line even though the actual LCD can only display 19 characters.

Using the panning function allows additional text to be viewed. This is most useful when viewing logged data samples, where the sample date and time information may be off the screen when the display is fully left.

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5.2.4 Display Menu Structure

The actual LCD screens that are available will depend upon the level of access that has been enabled (no access, not logged-in, or logged-in). The screens available in each mode are shown below:

1. Minimum Access (PIN code = 0, Log-in is not possible)

Level 0	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level6*
	Status 1					
	Status 2					
	Status 3					
	Status 4					
			Totalisers [1..4]			

2. View Only Access (PIN code <> 0, but user is not logged-in)

Level 0	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level6*
Log-In						
	Status 1					
	Status 2					
	Status 3					
	Status 4					
		Main Menu				
			Sensors [1..20]			
				Sensor Menu		
					Sensor Data	
			Totalisers [1..4]			
			Comms Status			

3. Full Access (PIN code <> 0 and user is logged-in)

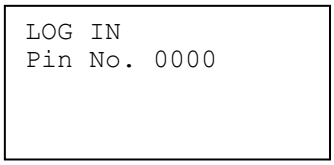
Level 0	*Level 1*	*Level 2*	*Level 3*	*Level 4*	*Level 5*	*Level6*
Log-Out						
	Status 1					
	Status 2					
	Status 3					
	Status 4					
	Log Control					
		Main Menu				
			Sensors [1..20]			
				Sensor Menu		
					Sensor Settings [1..5]	
					Sensor Calibration	
					Sensor Data	
			Totalisers [1..4]			
				Totalisers Reset		
			Comms Status			
				Comms Menu		
					Comms Settings [1..9]	
						RS232 Cfg
					Comms Enable	
					Comms Test	

To move down a level in the menu structure, press the <Enter> key. To move up a level press the <Alt> and <Enter> keys simultaneously. You can scroll through the screens that are followed by a number in square brackets (e.g. [1..4]) by pressing the + or - keys (stepping forwards and backwards respectively).

5.2.5 Primary LCD Display Screens

Log In Screen (Level 0, *when not logged in*)

The Log-In screen is a special screen that is allocated level 0. It is used to enter a PIN number and then enable access to restricted screens. It is reached by pressing the Alt and Enter keys simultaneously from any of the four System Status screens when the unit is not logged in.

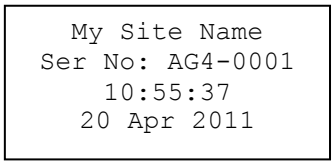


+/-	Increment/decrement PIN number
Enter	Multiply PIN number by 10 or accept PIN number as displayed. Moves back to System Status 1 screen

Once the PIN number matches that programmed into the device and the <Enter> key is pressed, the user will be logged in and returned to the top-level Welcome (System Status 1) screen. A successful login will also remove the padlock icon from the top of the display.

System Status 1 Screen (Level 1)

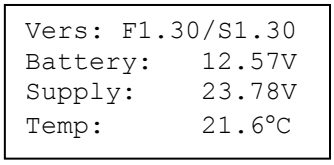
The System Status 1 screen is the default screen shown at system power up, hence its designation as display level 1. Useful information shown on this screen includes the site name, serial number and the current time and date.



-	Unused
+	Move across to System Status 2 screen
Enter	Move down to main menu screen
Alt Enter	Log in (If PIN code <> 0), otherwise unused

System Status 2 Screen (Level 1)

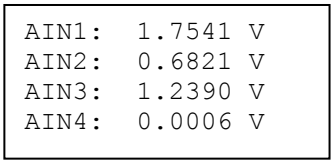
The System Status 2 screen is always available, no matter what level of access has been selected. The information shown on this screen includes the firmware (F) and software (S) version numbers, internal battery voltage, supply voltage and internal temperature.



-	Move back to System Status 1 screen
+	Move forward to System Status 3 screen
Enter	Move down to Main Menu screen
Alt Enter	Log in (If PIN code <> 0), otherwise unused

System Status 3 Screen (Level 1)

The System Status 3 screen is always available, no matter what level of access has been selected. The information shown on this screen includes the voltage being measured at the AI1 – AI4 terminals in volts. These values are useful for checking input signals and also for the calibration process.



-	Move back to System Status 2 screen
+	Move forward to System Status 4 screen otherwise unused.
Enter	Move down to Main Menu screen
Alt Enter	Log in (If PIN code <> 0), otherwise unused

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System Status 4 Screen (Level 1)

The System Status 4 screen is also always available, no matter what level of access has been selected. The information shown on this screen includes the current status of the digital channels whether they are an input (DIx:y) or an output (DOx:y) (where x is the channel and y is the state 0=OFF, 1=ON). This screen also shows the current alarms status (A) which is 1 if any alarms is active and the communications scheduler interval in minutes. Finally is displays the Start Of Data (SOD) and End Of Data (EOD) pointer values.

```
DI1:0  DI2:1  A:   0
DI3:0  DO4:0  I: 360
SOD Ptr:      177104
EOD Ptr:      177336
```

-	Move back to System Status 3 screen
+	Move to Logging Control screen if logged in. Unused otherwise.
Enter	Move down to Main Menu screen
Alt Enter	Log in (If PIN code <> 0), otherwise unused

Logging Control Screen (*only accessible when logged in*)

The Logging Control screen is a special screen that is only available on level 1 when a user is logged in. It can be used to temporarily disable logging when the logged in user is making changes to or testing sensors and does not want to have the data logged. It is reached by pressing the + key from Status Screen 4. Use the Enter key to toggle logging on or off. If the logging is disabled, it is always re-enabled automatically when the user logs out, either manually or on inactivity timeout.

```
LOGGING CONTROL
Use Enter key to
Enable/disable.
=> Enabled
```

-	Move back to System Status 4 screen
+	Unused
Enter	Toggle logging on or off
Alt Enter	Unused

Use the – or + keys to switch the logging on or off. Pressing the <Enter> key will return the display to the top-level Welcome (System Status 1) screen.

Main Menu Screen (Level 2)

The Main Menu screen is used to select which type of information you want to look at.

```
MAIN MENU
>Sensors
 Totals
 Comms
```

+/-	Move down/up through menu
Enter	Select menu item
Alt Enter	Move up to System Status 1 screen

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5.2.6 Sensor Related Screens

Sensor Status Screen (Level 3)

This screen provides an overview of each sensor.

Line 1 indicates sensor ID, data source and its composite status including:
- '**.**' if sensor is enabled
- '**:**' if sensor and alarm(s) are enabled
- '*****' if sensor and alarm(s) are enabled and alarm(s) currently active

Line 2 indicates the raw input value.
Line 3 indicates the scaled (engineering unit's) value.
Line 4 indicates the last logged value.

```
1:  Bat Volt
Input:    1257
Scaled:   12.57
Logged:   12.62
```

+/-	Move forwards/backwards through sensors
Enter	Move down to Sensor Menu screen
Alt Enter	Move up to Main Menu screen

Sensor Menu Screen (Level 4)

The Sensor Menu screen is used to select sensor options.

```
SENSOR MENU
>Settings
 Calibration
 Data
```

+/-	Move down/up through menu
Enter	Select menu item
Alt Enter	Move up to Sensor Status screen

Sensor Settings Screen 1/9 - Process (Level 5)

The Sensor Process screen shows the processing mode used to convert the incoming raw data to engineering units.

```
PROCESS  1/9
Mode
Instant
```

+/-	Move forwards/backwards through sensor setting screens.
Alt Enter	Move up to Sensor Status screen

Sensor Settings Screen 2/9 - Scaling (Level 5)

The Sensor Scaling screen shows the multiplier and offset used to convert the incoming raw data to engineering units.

```
SCALING  2/9
x     0.0010
+     0.0000
```

+/-	Move forwards/backwards through sensor setting screens.
Alt Enter	Move up to Sensor Status screen

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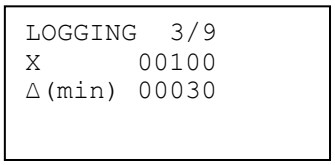
Sensor Settings Screen 3/9 - Logging (Level 5)

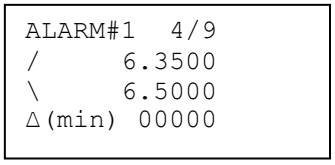
The Sensor Logging screen shows the multiplier used when logging sensor data and the rate at which that data is logged.



+/-	Move forwards/backwards through sensor setting screens.
Alt Enter	Move up to Sensor Status screen

Sensor Settings Screens 4/5 - Alarm 1 (Level 5)

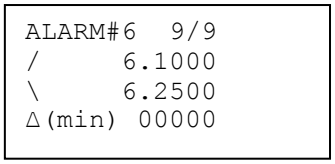
Sensor Alarm screen 1 shows the trigger and reset levels used to generate an alarm and the duration used to qualify the alarm. If the sensor gets its data from an analogue input, the duration is used to provide an alarm delay. If the sensor is a pulse input counter, the logged data is totalised over the duration before comparing to the alarm trigger and reset levels.



+/-	Move forwards/backwards through sensor setting screens.
Alt Enter	Move up to Sensor Status screen

Sensor Settings Screen 5/9 to 9/9 - Alarms 2 to 6 (Level 5)

Sensor Alarm screens 5-9 shows the same information as Alarm screen 1, but for Alarms #2 to #6.

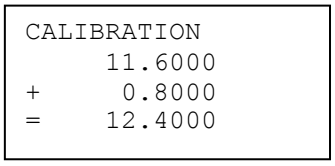


+/-	Move forwards/backwards through sensor setting screens.
Alt Enter	Move up to Sensor Status screen

Sensor Calibration Screen (Level 5)

The Sensor Calibration screen is provided as a convenient tool for adjusting the sensor scaling offset on site, without a tool such as a laptop being required. The calibration process is done by entering the actual sensor value as measured by an external reference source such as a gauge board, EPB or thermometer.

- The top value on the display is the current, unadjusted sensor value reading. This is the value as it would be with the offset set to zero (y=mx+0). I.e. Raw value (x) multiplied by the multiplier (m).
- The middle value is the interim calibration offset that is calculated continually by the iRIS, subtracting the unadjusted value from the target value being entered via the keypad.
- The bottom value on the display is the target value which is entered by the user to match the actual value measured externally. NOTE: When this screen is first shown, the target value will be set to zero.



+/-	Increment / decrement target value on bottom line. **NOTE: If Enter is pressed while either the + or – key is already down, the interim target value is reset to zero. This is useful when removing a value that is excessive.**
Enter only	Multiply target value by factor of 10
Alt Enter	Move to Calibration Acceptance screen

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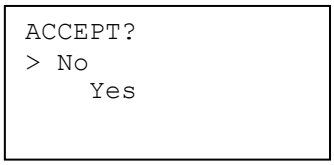
Sensor Calibration Acceptance Screen (Level 5)

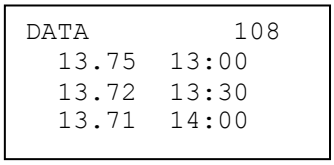
The Sensor Calibration Acceptance screen is used to accept or decline the sensor calibration. If No is selected, the calibration offset is discarded. If Yes is accepted, the interim offset entered in the calibration screen previously is stored in the sensor's offset location and overwrites the previous value.



+/-	Move down / up through available options
Enter	Accept current selection

Sensor Data Screen (Level 5)

The Sensor Data screen is used to view the logged sample data for a sensor. The data pointer value for the top sample is displayed on the top right hand side.

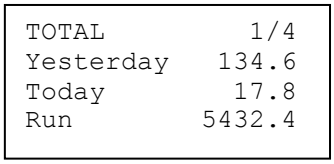


+/-	Move forwards/backwards through sample values.
Alt Enter	Move up to Sensor Status screen
Alt +/-	Pan left/right to view the rest of the sample time & date information.

5.2.7 Totaliser Related Screens

The Totaliser screens show yesterday's total (from 00:00:00 to 23:59:59 yesterday), the daily (since 00:00:00 today) and running (since last totaliser reset) totals for the two pulse input counters.

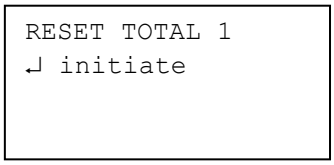
Total Screen x/4 (Level 3)



+/-	Move forwards/backwards through sensor total screens
Enter	Move down to Total Reset screen
Alt Enter	Move up to Main Menu screen

Reset Total Screen (Level 4)

The Total Reset screen is used to reset the two daily and the running totals for the selected totaliser.



Enter	Reset total and move up to Sensor Total screen
Alt Enter	Move up to Sensor Total screen

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5.2.8 Comms Related Screens

Comms Status Screen (Level 3)

The Comms Status screen displays the current state of the wireless IP or CSD connection. The RSSI display shows the Received Signal Strength Indication (RSSI) in dBm followed by the Bit Error Rate (BER).

The iRIS will not attempt to connect if the RSSI value is invalid (0 or < -113dBm).

```
IP STATUS
Ready
- Off Line -
RSSI: -75dBm,00
```

Enter	Move down to Comms Menu screen
Alt Enter	Move up to Main Menu screen

Comms Menu Screen (Level 4)

The communications menu screen is used to select communication options.

```
COMMS MENU
>Settings
 Enable
 Test Call-In
```

+/-	Move down/up through menu
Enter	Select menu item
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 1/8 - Protocol (Level 5)

The Protocol screen displays the station (logger's) address and the type of base that the unit must communicate with (HydroTel™ or Other).

```
IP          1/8
PROTOCOL
Address       123
HydroTel
```

+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 2/8 – APN / Local IP (Level 5)

The APN screen displays the name of the access point used to connect to the wireless network. It also displays the local IP address allocated to the SIM card inserted in the unit for static IP address applications or the most recent IP address assigned by the network when in dynamic IP mode.

```
IP            2/8
APN/LOCAL IP
iquest.co.nz
10.236.0.1
```

+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

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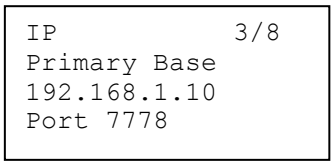
Comms Setting Screen 3/8 - Primary Base (Level 5)

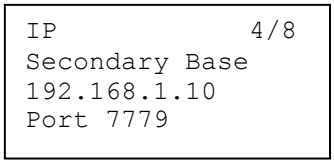
This screen displays the remote IP address and port number to use for communication with the primary base.



+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 4/8 - Secondary Base (Level 5)

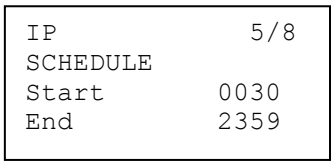
This screen displays the remote IP address and port numbers to use for communication with an optional secondary base. If only a single base is used, these settings should be the same as the primary base.



+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 5/8 - Schedule 1 (Level 5)

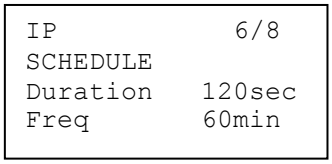
This screen displays the time range during which the unit is allowed to make a connection to the wireless network. Refer to the Communications Schedule (Section 4.4.3) for details on how these settings affect the communication availability.



+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 6/8 - Schedule 2 (Level 5)

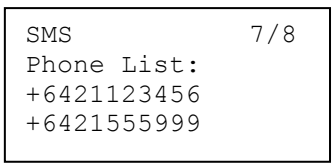
This screen displays the duration that the unit will stay connected to the wireless network and the frequency at which connections will be made during the allowable time range. Refer to the Comms Schedule (Section 4.4.3) for details on these settings affect the communication availability.



+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

Comms Setting Screen 7/8– SMS Settings (Level 5)

This screen displays the primary and secondary phone numbers for the iRIS to use when it initiates the sending of a SMS text message (SMS call-back mode).



+/-	Move forwards/backwards through communication setting screens.
Alt Enter	Move up to Comms Status screen

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Comms Setting Screen 8/8 – RS232 Settings (Level 5)

This screen displays the RS232 port status and mode. The port can be in one of two states, “Normal” or “User”.

Normal: is the default setting and this is the mode that needs to be selected if a terminal session is to be established with the iRIS.

User: If the application program has the appropriate serial driver code included (a user script), then the RS232 port can be used to communicate with an external device such as an intelligent sensor. In this situation, the user script will typically store the retrieved values in reserved database locations for access by the virtual sensors set to source types 17 or 18. See Section 4.4.9 for details on sensor sources.

When the RS232 port is set to User mode, the name of the user script (if installed) is displayed on the LCD as well.

```
RS232        8/8
Port Mode is
NORMAL
Enter to chg
```

+/-	Move forwards/backwards through communication setting screens.
Enter	Move to RS232 Mode screen
Alt Enter	Move up to Comms Status screen

RS232 Port Mode Screen (Level 6)

The RS232 Port Mode screen is used to swap the operating mode of the RS232 port between the Normal and User modes.

```
RS232 PORT
↵ Enter for User
```

+/-	Not used.
Enter	Select new mode displayed and move back to Comms Setting Screen 9
Alt Enter	Move up to Comms Setting Screen 9, but with mode left unchanged

Comms Enable Screen (Level 5)

The Comms Enable screen is used to enable/disable the establishment of a wireless IP session. This option will initiate a connection even if the scheduler is configured, but not at a scheduled connection time.

```
GPRS CONNECT
↵ enable
```

Enter	Enable/disable IP session establishment
Alt Enter	Move up to Comms Status screen

Comms Test Screen (Level 5)

The Comms Test screen is used to initiate a user connection to the wireless network based on the call-back mode and then send an announcement message to the base station or destination cellular phone. If the base type is set to “Auto Send” the unit will forward any unreported data to the base station.

This may mean connecting to the wireless network (when mode = IP), or simply sending a text message (when mode=SMS).

The actual call-back message sent and the communication method used depends on the call-back mode and base type settings. See Section 4.4.3 (Comms Cfg) for further details.

```
CALL-IN TEST
↵ initiate
```

Enter	Initiate comms test and move up to comms status screen
Alt Enter	Move up to comms status screen

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5.3 SMS Communication

The iRIS can send a standard text message in response to a request received via SMS (see Section 5.3.1 below). If the call-back mode is set to 2 (SMS) a message is also sent if an alarm is activated, a comms scheduler trigger occurs or user initiated communications test is done.

The SMS message is constructed from the logger's date and time, site name plus the sensor number, name and current value of all the enabled sensors and finally the last measured RSSI value. The format is best shown in this example:

12/06/2009 12:34:56 My Site Name,1:Water Lvl= 27.69,2:Batt Volts=12.73,3:Supp Volts= 23.90,RSSI=19

If the message was sent because of an alarm event, the message will have the prefix "ALM!" at the start of the message.

5.3.1 SMS Text Commands

The iRIS can also accept incoming SMS messages and if they are valid it will respond appropriately. To use this function, simply send a text message to the iRIS voice number with a message as described below. The message is not case-sensitive. The two commands currently supported are:

Request Current Sensor Values. Send the message "RQ". The iRIS will reply with the standard SMS message described above. If the requester message does not begin with RQ, the response will be the message "Invalid command!"

Go On-Line. Send "GOL". This is useful as a poll-on-demand type function. The iRIS will not reply to this command, but will immediately initiate a wireless connection of the type defined in the Callback Mode setting. Typically this is an IP connection, but could be a CSD dial-up connection or even an SMS message (but to the numbers defined in the Phone Number configuration, not the requester's number).

The SMS function is only available if the SMS service has been enabled in the SIM card and there is not a wireless IP session active.

If the call-back mode is set to IP, then the iRIS will respond to incoming SMS requests, but will not send an SMS message if an alarm occurs or the communication test function is initiated from the LCD/keypad. In this situation, the iRIS will attempt to establish a wireless IP link..

5.4 General Hints

- If the iRIS will be installed in an outdoor situation, try to ensure that the LCD is facing away from direct sunlight. This will help to enhance the readability of the display.
- If the unit is not to be used for some time, disconnect the internal battery to prevent it discharging.
- Always check the time and date are correct when commissioning the unit. Take into account daylight saving, which is almost universally not used in datalogging applications to maintain data currency. Datalogger clocks are generally set to standard time in the local time zone.
- Immediately following installation, use the initialisation function (available on the Miscellaneous terminal menu) to clear data and totals that may have been logged before the commissioning. See Section 4.4.18.
- The three iRIS 350X application program segments (.irx files) can normally be upgraded with no effect upon the logged data or iRIS configuration. In the case of a major upgrade that may affect the internal memory of the unit, iQuest will issue an upgrade notification explaining the procedure that should be followed when upgrading your unit. See Section 15 Appendix E – Upgrading Firmware/Software for details on how to upgrade the firmware and software in an iRIS.

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6 Sensor Connection Examples

6.1 Introduction to Connection Examples

The generic examples on the following pages are included to give a basic overview of how to connect standard / common instrument types to the iRIS and configure it to suit them.

For more detailed or specialised examples, please refer to the Application Notes section on the iQuest website.

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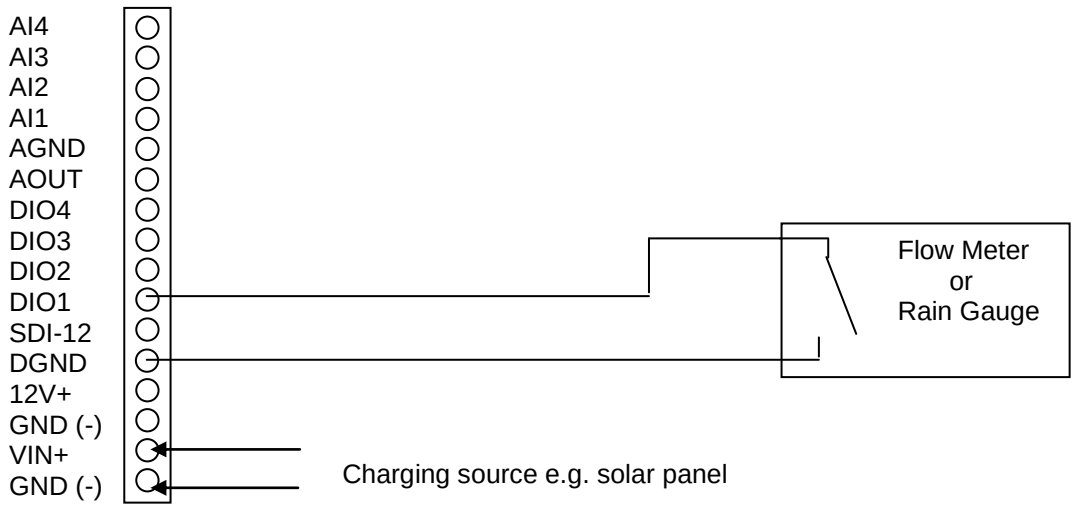
6.2 Connecting a Flow Meter or Rain Gauge

A common use for the iRIS is logging data from pulse sources such as flow meters or rain gauges. Connecting such devices to the iRIS is very simple – wire the switch between the appropriate digital input (DIO1 or DIO2) and the digital ground (DGND) terminal. Both of the digital inputs provide a "wetting current" for clean contact sources, but transistor switches and active signals (ones that supply a voltage) can also be used. If a transistor switch is used, connect the collector (+) to the digital input and the emitter (-) to the DGND. See Section 3.3.5 for details on the digital inputs and setting up the input debounce mode.

Both inputs can be used simultaneously and each input has three associated totalisers, which are viewable from the LCD. See section 5.2.7. These totalisers operate even if the input is not configured as a source to one of the six virtual sensors.

The diagram below shows the typical connection diagram for such an installation. It assumes the use of DIO1 as the pulse input channel. The charging source can be any d.c supply from 15V – 30V, including a directly connected solar panel.



The sensor should be configured for the correct channel, scaling and logging regime as described in section 4.4.9. Event mode (sensor mode=2) can be used to reduce the quantity of data logged, especially for rainfall where the actual data density is low.

Three typical sensor configuration examples for this type of instrument are shown below. The instrument is a 0.5mm tipping bucket rain gauge and is logged every 15 minutes for examples 1 and 2.

```
*  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [5: Pulse1]
2 Name [Rainfall]
3 Mode [Instant]
4 Multiplier [  0.500]
5 Offset [   0.0000]
6 Reject [L  0.000],[H 0.000]
7 Log Rate [15 min],Log Mult[10]
8 Alarms
9 Data
```

Example 1: Normal Timed
This logs the total every 15 minutes, even if it is zero. This produces the most data as every "time slot" has an associated sample.

```
 *  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [5: Pulse1]
2 Name [Rainfall]
3 Mode [Event]
4 Multiplier [  0.500]
5 Offset [   0.0000]
6 Reject [L  0.000],[H 0.000]
7 Log Rate [15 min],Log Mult[10]
8 Alarms
9 Data
```

Example 2: Timed Event
This logs the total every 15 minutes only if it is non-zero. It also inserts a zero record one log interval earlier, if there has not been a value logged.

```
 *  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [5: Pulse1]
2 Name [Rainfall]
3 Mode [Event]
4 Multiplier [  0.500]
5 Offset [   0.0000]
6 Reject [L  0.000],[H 0.000]
7 Log Rate [0 min],Log Mult[10]
8 Alarms
9 Data
```

Example 3: True Event
This logs every event to a one second resolution. If there is more than one count in a second, the total is logged. No zero samples are logged.

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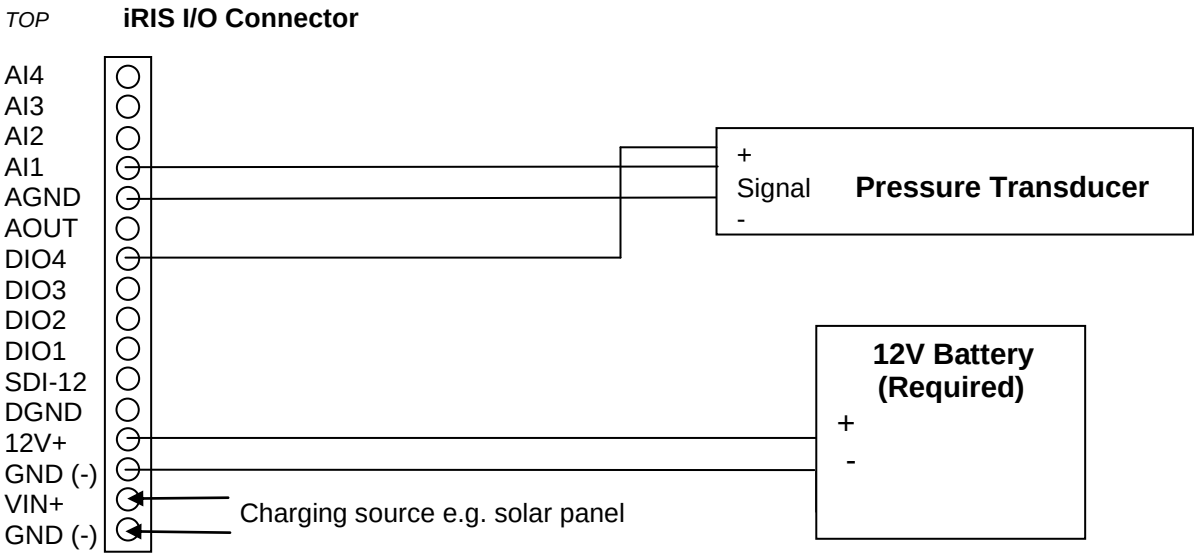
6.3 Connecting a 0-5V Pressure Transducer

Connecting a standard sensor (such as a pressure transducer that provides a 0-5V signal) to an iRIS is relatively straightforward. The sensor can be powered from the iRIS's 12V supply and optionally controlled by a digital output to save power.

However, the iRIS's internal battery is NOT recommended for directly powering the sensor alone if the charging source is a solar panel, as it is a relatively low capacity type. Connect a supplementary external 12V battery (7A/Hr or larger) to increase the available storage.

The diagram below shows the typical connection diagram for such an installation. It assumes the use of AI1 as the desired input channel. It also shows the connection of the switched supply from DIO4.



The sensor should be configured for the correct channel, scaling and logging regime as described in Section 4.4.9. Also, see Section 8 for a description of how to accurately scale the sensor.

A typical sensor configuration example for this type of installation is shown here. The instrument is a 10 metre, 0-5V output pressure transducer. The level is averaged and the result logged every 15 minutes.

```
*  Sensor 1 Cfg
(Now:  6.2454 [3.1226V]
0 Exit
1 Source [1: Analogue1]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  2.0000]
5 Offset [  0.0000]
6 Reject [L  0.000],[H 0.000]
7 Log Rate [15 min], Log Mult [1000]
8 Alarms
9 Data
```

The iRIS supports activation of digital outputs with a schedule. See Section 4.4.15 for more details and an example. Therefore, if further power reduction is to be achieved by controlling the transducer power, follow this procedure:

1. ***Connect the transducer supply to a digital I/O channel to be used as the switched 12V output (e.g. DIO4)***
2. ***Configure the digital output's mode to be Schedule (Mode = 1) and the Polarity to be Normal Pull-Up (Polarity = 2).***
3. ***Set up the digital output's schedule to match the sensor's logging period, but with the digital output being set to activate the desired amount of time before the sensor is to log and with sufficient "on" time to ensure an overlap with the logging time.***
4. ***Ensure the sensor mode is set to Instant (0) or 1 minute average (4).***

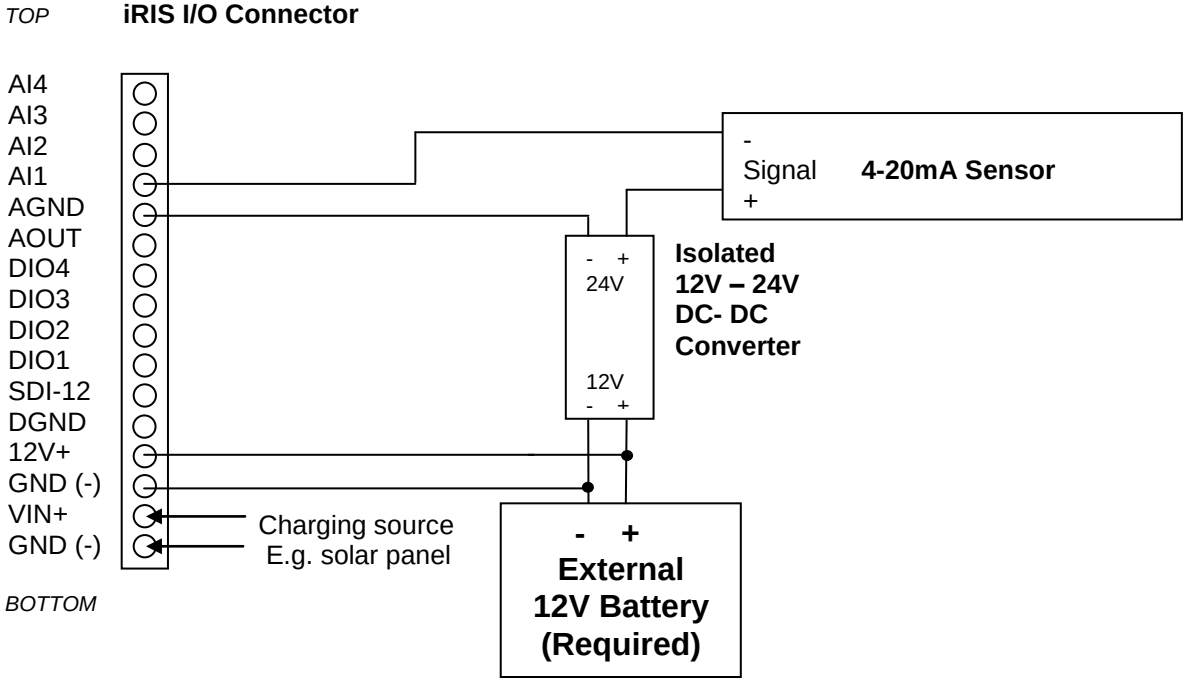
6.4 Connecting a 2-Wire Loop-Powered 4-20mA Sensor

The iRIS also supports the connection of many types of industry standard 4-20mA current loop instruments such as ultrasonic or radar level sensors. A very common configuration used with these devices is known as two-wire or loop-powered mode. This requires only two wires to the sensor and the 4-20mA loop current provides power for the sensor as well as being the proportional analogue sensor signal.

However, these sensors often require a minimum voltage across them that may not be reliably achieved with a 12V supply, taking into account the voltage drop across the current sink resistor. In such cases, a separate 12-24V boosted sensor supply is recommended.

The diagram below shows the recommended connection diagram for such an installation. It assumes the use of AI1 as the desired input channel. The current sink resistor should be enabled for the appropriate analogue input. **See Section 3.3.4 for details on the analogue input links.**

The internal 100Ω current sink resistor generates a 0.4 to 2V signal (from the 4 to 20mA current), which is then measured at the analogue input. The sensor should be configured for the correct channel, scaling and logging regime as described in Section 4.4.11. An offset value will be required as part of the configuration, as the 4mA (0.4V) offset needs to be eliminated.



A typical sensor configuration example for this type of installation is shown here. The instrument is a 10 metre, 4-20mA output ultrasonic transducer. The level is averaged and the result logged every 15 minutes.

```
*  Sensor 1 Cfg
(Now:  6.1200 [1.3792V]
0 Exit
1 Source [1: Analogue1]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  6.2500]
5 Offset [  -2.5000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [15 min], Log Mult [10]
8 Alarms
9 Data
```

If power consumption is an issue, the sensor can be controlled by a digital output on a timed basis. See the description in Section 6.3 above.

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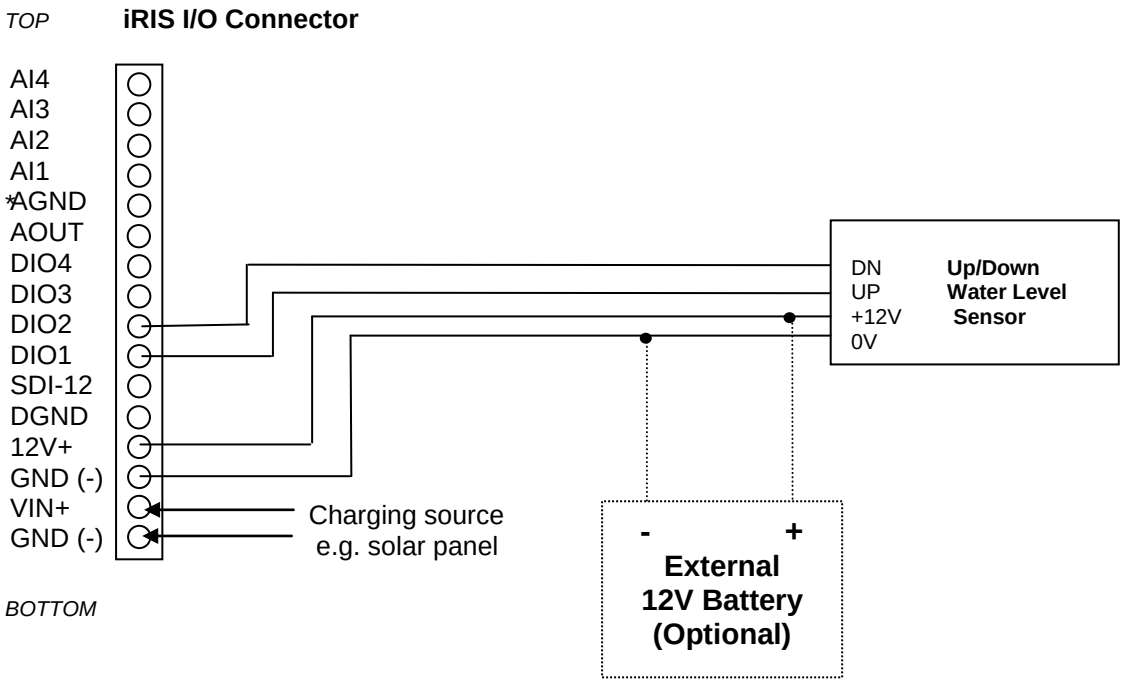
6.5 Connecting an Up/Down Water Level Instrument

A relatively common type of digital water level instrument is one that provides two pulse outputs. One output generates a pulse for each increment and the other for each decrement in level. The iRIS maintains a record of these steps and therefore the relative level.

This instrument type is NOT the same as a quadrature encoder which uses the relative phase of the two signals to determine direction. See Section 6.9 for details on the quadrature sensors.

These instruments normally require a 12V supply and this is readily obtained from the iRIS. A supplementary 12V battery can be connected if desired. Typically, this type of instrument requires very little current, so the internal iRIS battery will normally suffice.

The diagram below shows the required connects for such an installation. The incrementing output must be connected to DI1 and the decrementing output to DI2.



A typical sensor configuration example for this type of installation is shown below. The instrument is a standard digital up/down water level encoder. The level is averaged and the result logged every 15 minutes.

```
*  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [15: Up/Dn]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  0.001]
5 Offset [  0.000]
6 Reject [  0.000]
7 Log Rate [15 min], Log Mult [1000]
8 Alarms
9 Data
```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6.6 Connecting a Unidata High-Speed Serial Instrument

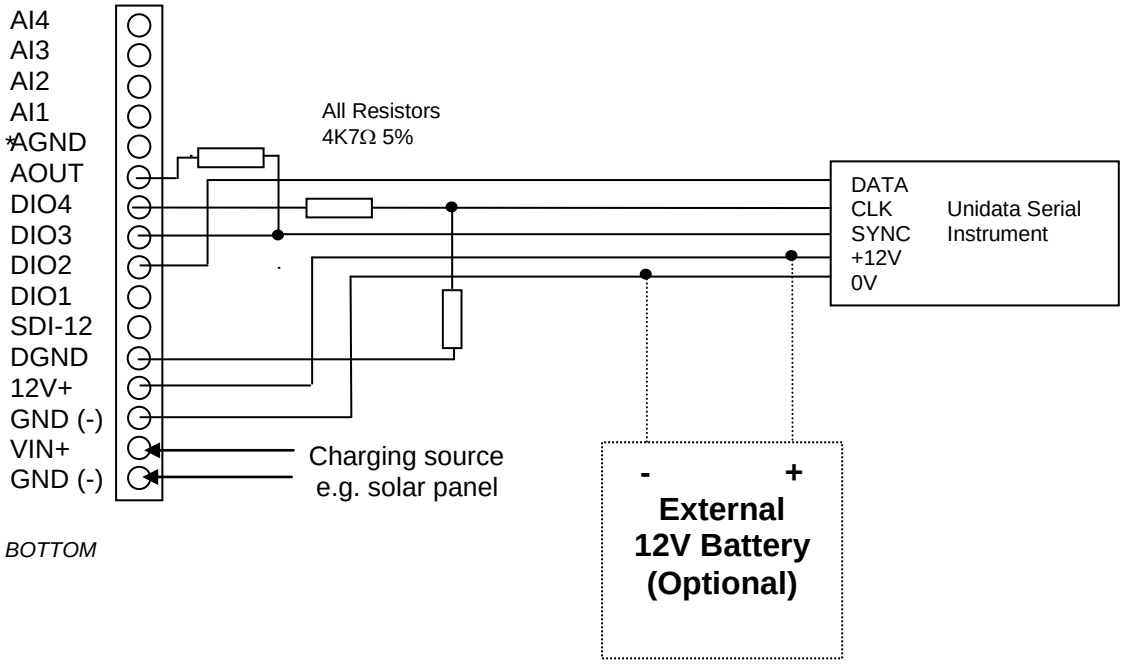
Unidata high-speed serial instruments are supported by the iRIS, but with some conditions.

1. Only 16 bit (two-byte) instruments can be used. Most water level encoders are of this type.
2. A small hardware adaptor is required to interface the iRIS I/O to the instrument. This adaptor comprises three 4K7 resistors as shown in the diagram.

The Unidata instruments normally require a 12V supply and this is readily obtained from the iRIS. A supplementary 12V battery can be connected if desired. Typically, this type of instrument requires very little current, so the internal iRIS battery will normally suffice. The diagram below shows the required connections for such an installation. The connections must be done as listed.

Instrument	**iRIS**
SYNC	DIO3 with a 4K7 pull-up resistor to AOUT terminal set to a 5V output level.
CLOCK	DIO4 with two 4K7 resistors to adjust the voltage levels
DATA	DIO2 configured as an input.

TOP **iRIS I/O Connector**



BOTTOM

A typical sensor configuration example for this type of installation is shown below. The instrument is a Unidata 6809 serial water level encoder. The level in metres is averaged and the result logged every 15 minutes. The digital outputs are used to enable and clock the sensor. Outputs 3 and 4 should be enabled, but set to an empty schedule with the polarity set as shown as the firmware controls the channels internally. The digital output configuration is shown below.

```
*  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [16: HS SerI]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  0.001]
5 Offset [  0.000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [15 min], Log Mult [1000]
8 Alarms
9 Data
```

```
*  Digital Output 3 Cfg

0  Exit
1  Mode [1: Schedule]
2  Polarity[Nml (Pull-Dn)]
3  Duration [0 sec]
4  Interval [0 min]
5  Start Time [0000]
6  End Time [0000]
```

```
*  Digital Output 4 Cfg

0  Exit
1  Mode [1: Schedule]
2  Polarity [Inv (Sw 12V)]
3  Duration [0 sec]
4  Interval [0 min]
5  Start Time [0000]
6  End Time [0000]
```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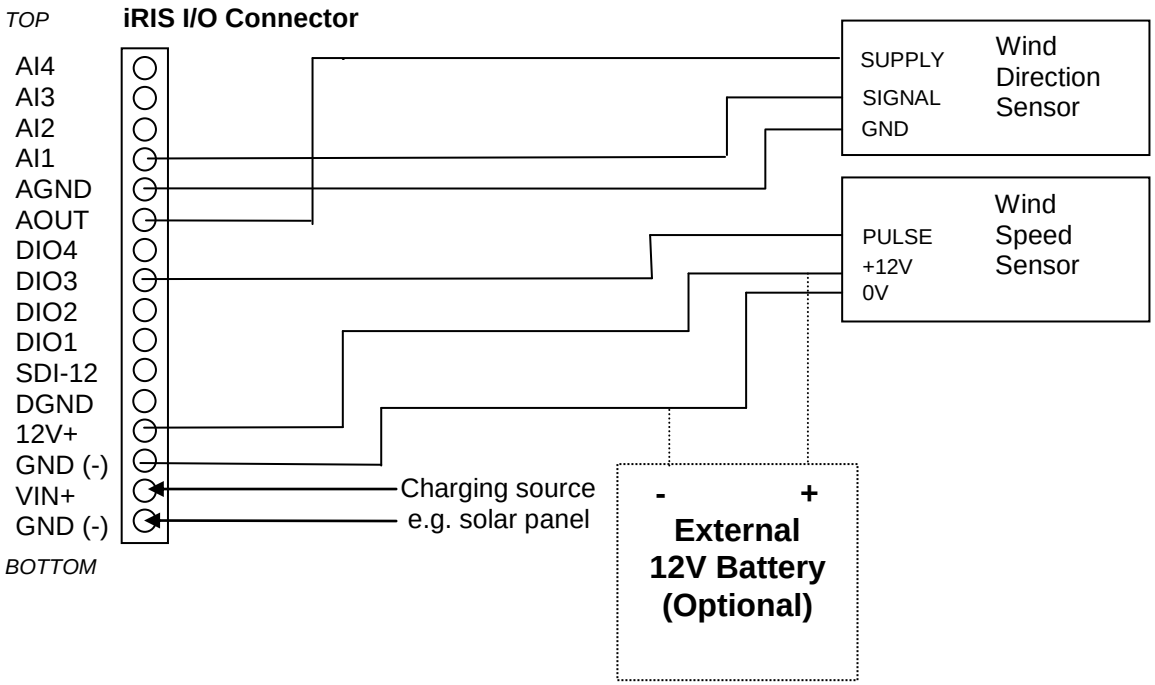
6.7 Connecting Analogue Wind Instruments

Many wind measurement instruments operate in an analogue mode. The wind direction sensor is usually a potentiometer which is driven by the buffered 5.0V analogue output from the iRIS. The wiper signal is connected to one of the analogue inputs. As the iRIS analogue inputs have low pass filtering included, there is no need for external components to remove noise. The anemometers usually provide a switched pulse signal from a transistor or opt-coupler. This drives a digital input, operating in counter mode and the frequency is measured, scaled and logged.

For the anemometer to operate correctly, the pulse amplitude must be at least 3V p-p. Some instruments emit a low level a.c signal in the order of millivolts. In these cases a simple transistor switch to create a suitable pulse must be included. Please contact iQuest for details.

The diagram below shows a typical installation.



A typical sensor configuration example for this type of installation is shown below. The instruments are a Vector A101M wind speed sensor providing pulses that are converted to metres/sec and a Vector W200P wind direction sensor. The speed and direction are averaged and the results logged every 10 minutes and the wind speed min and max (lull and gust) are also logged. The wind direction is stored in whole degrees and has a log multiplier of 1.

```
*  Sensor 1 Cfg
(Now:  3.11)
0 Exit
1 Source [13: Freq 1]
2 Name [Wind Spd]
3 Mode [Period Avg+Min+Max]
4 Multiplier [  0.010]
5 Offset [  0.000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [10 min], Log Mult [10]
8 Alarms
9 Data
```

```
*  Sensor 2 Cfg
(Now:  176.00)
0 Exit
1 Source [1: Analogue1]
2 Name [Wind Dir]
3 Mode [Scalar Avg]
4 Multiplier [  71.800]
5 Offset [  0.000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [10 min], Log Mult [1]
8 Alarms
9 Data
```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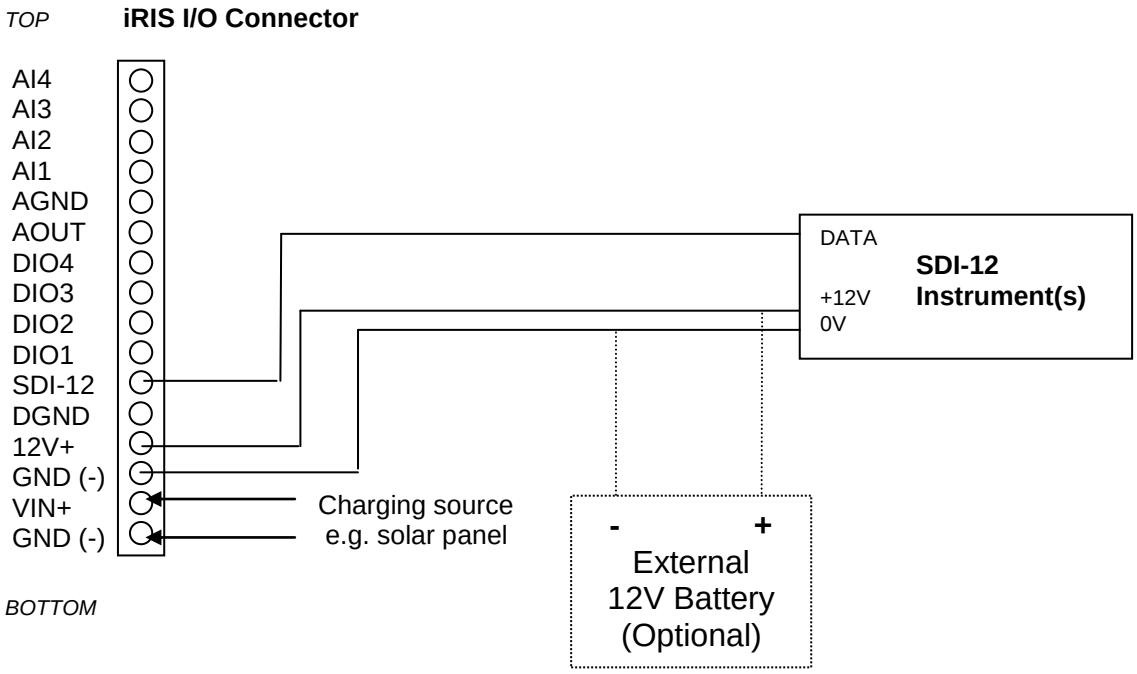
6.8 Connecting SDI-12 Instruments

SDI-12 instruments should be connected as shown in the diagram below. See Section 4.4.3 for information on using the SDI-12 terminal mode to access SDI-12 instruments directly. Also, refer to Appendix F – SDI-12 for detail on the SDI-12 specification.



An example sensor configuration example for this type of installation is shown below. The instrument is a standard SDI-12 compatible water level sensor, set to address 0. The level is the first value in the SDI-12 response obtained from the sensor and is read in metres. The offset of 6.177 is the hypothetical offset at the site to correct the readings to true RL. The corrected level is averaged and the result logged every 15 minutes. The logging multiplier of 1000 is necessary to maintain resolution for the logged data which is stored in millimetres.

```
*  Sensor 1 Cfg
(Now: 12.445)
0 Exit
1 Source [19: SDI12 0,1]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  1.000]
5 Offset [  6.177]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [15 min], Log Mult [1000]
8 Alarms
9 Data
```

The SDI-12 measurements are taken at a rate determined by the mode of the FIRST SDI-12 sensor defined in the iRIS. If its mode is **Instant**, then a measurement is initiated one minute before logging will occur (e.g. on the 14th, 29th, 44th and 59th minute of each hour if the log rate is 15 mins. If the mode is **Period Avg (1) or 1 Min average (4)**, then measurements are initiated at a rate of 10 seconds (plus time for measurement to be ready). If a user is logged in via the LCD/keypad, then measurements are taken at the faster rate no matter what the mode of the first SDI-12 sensor is set to. This allows easy calibration and checks to be performed.

To cater for unusual situations where the combined time to take a measurement from all the SDI-12 instruments will exceed one minute, a compromise mode is provided. In this case, the SDI-12 instrument measurement cycle can be set to start two minutes before logging. ***This is done by setting the address of the first SDI-12 instrument to 5 or greater.***

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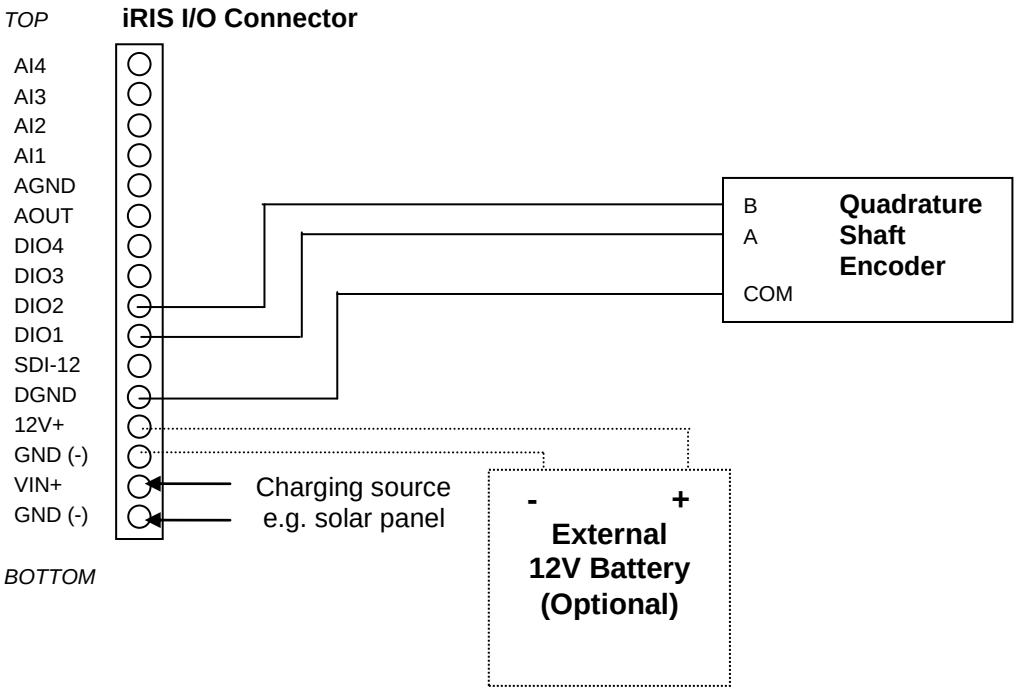
6.9 Connecting Quadrature Encoders

A commonly used type of digital water level instrument is one that provides two pulse outputs, the direction of movement being determined by the phase difference between the two signals. The iRIS tracks these steps and therefore the relative water level.

These instruments are passive and do not require a power supply. This implementation makes use of the two digital inputs, DIO1 and DIO2 as the reference channel and auxiliary channels respectively.

The diagram below shows the connections. The debounce links for DIO1 and DIO2 should be fitted.

If the direction is incorrect, reverse the two channels.



A typical sensor configuration example for this type of installation is shown below. The instrument is a standard quadrature water level encoder. The level is averaged and the result logged every 15 minutes.

```
*  Sensor 1 Cfg
(Now:  0.0)
0 Exit
1 Source [20: Quadrat]
2 Name [Water Lvl]
3 Mode [Period Avg]
4 Multiplier [  0.001]
5 Offset [  0.000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [15 min], Log Mult [1000]
8 Alarms
9 Data
```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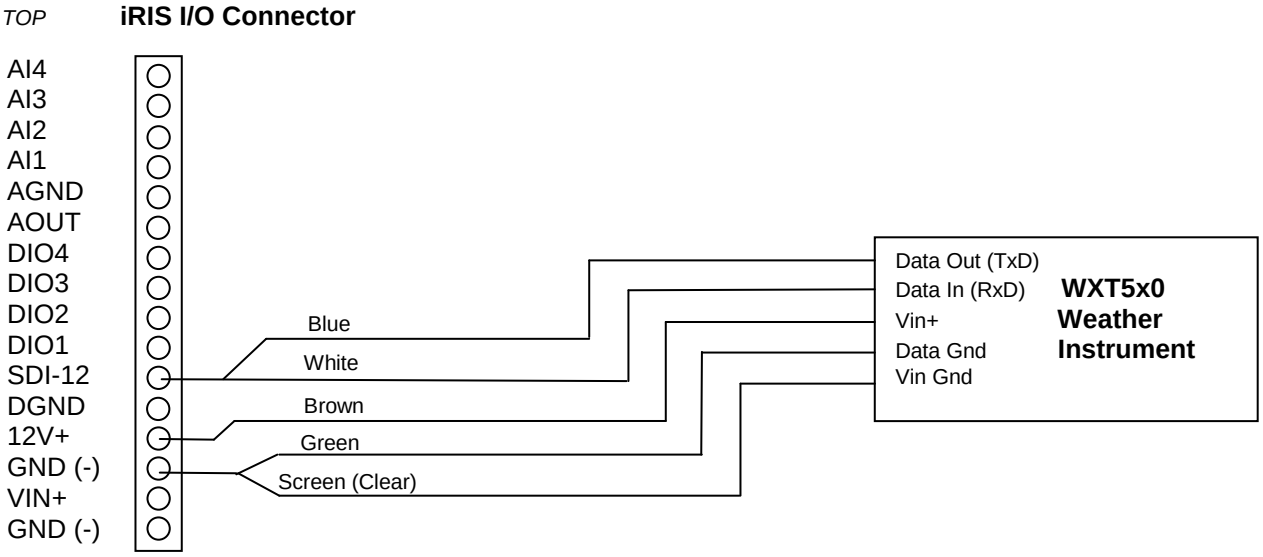
6.10 Connecting a Vaisala WXT5x0 Weather Transmitter

The Vaisala WXT5x0 Weather Transmitter is a compact, well-featured instrument that is ideal for implementing small weather stations. The iRIS supports the connection of these units using the SDI-12 interface.

The instrument should be connected as shown below. The SDI-12 interface adaptor is omitted for clarity. This diagram assumes the use of the optional interface cable that is provided by Vaisala. Cover the screen wire (clear) and unused wire ends (pink, yellow and grey) heater with sleeving or heatshrink tubing to avoid short circuits.



6.10.1 Configuration

Use the Vaisala WXT Configuration Tool to set up the WXT5x0 to provide the correct composite message and processing settings. Then configure the iRIS sensor settings to suit the instrument.

The screen shots on the next page (Section 6.10.2) show the settings that are recommended for this application.

The last subsection, (Section 6.10.3) shows the settings for each of the sensors to enable the WXT5x0 data to be acquired and logged.

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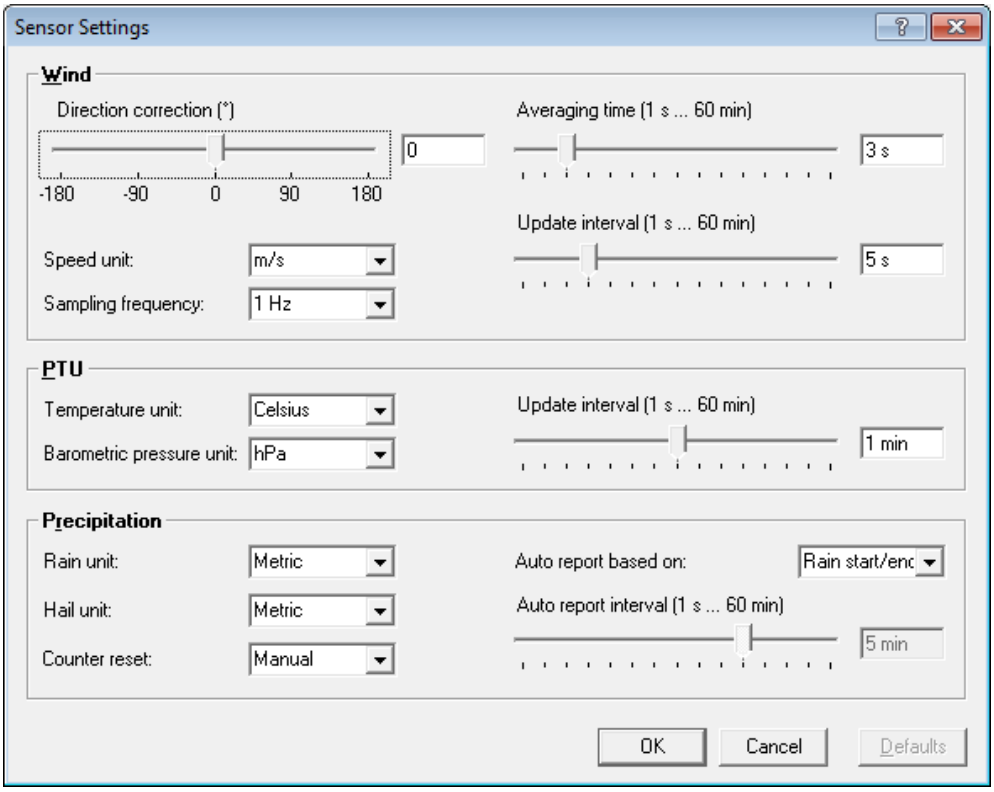
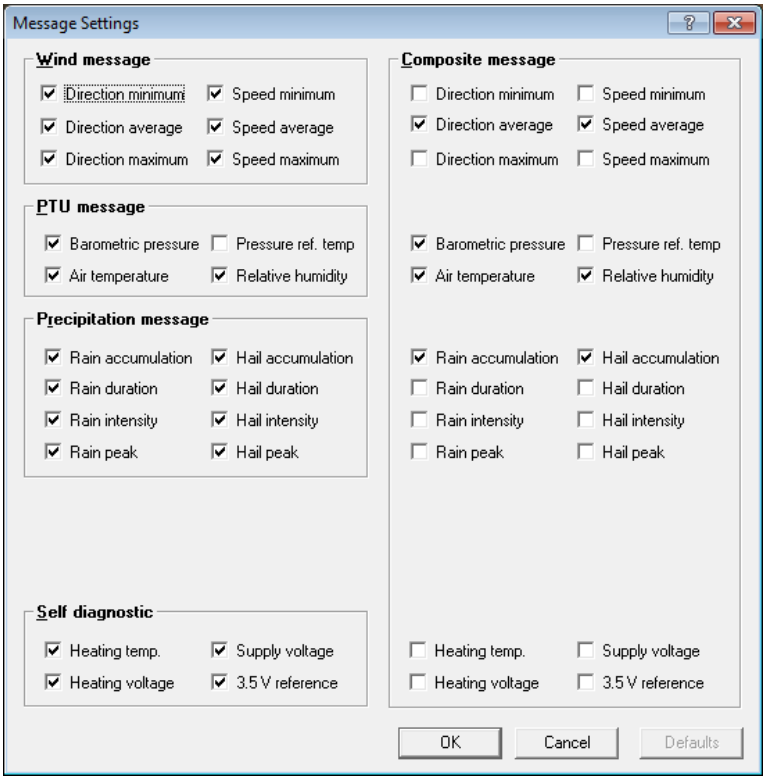
6.10.2 Vaisala Configuration Software Settings





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6.10.3 iRIS Sensor Configuration

Once the Vaisala has been configured (as shown in Section 6.10.2 above), the iRIS can be then be configured with the following sensor settings:

```
* Sensor 1 Cfg
(Now:    93.000)
0 Exit
1 Source [19: SDI 0,1]
2 Name [Wind Dir]
3 Mode [Scalar Avg]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [1]
8 Alarms
9 Data
>
```

```
* Sensor 2 Cfg
(Now:     0.665)
0 Exit
1 Source [19: SDI 0,2]
2 Name [Wind Spd]
3 Mode [Period Avg+Min+Max]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

```
* Sensor 3 Cfg
(Now:    22.800)
0 Exit
1 Source [19: SDI 0,3]
2 Name [Air Temp]
3 Mode [Instant]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

```
* Sensor 4 Cfg
(Now:    39.000)
0 Exit
1 Source [19: SDI 0,4]
2 Name [Humidity]
3 Mode [Instant]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

```
* Sensor 5 Cfg
(Now:  1019.400)
0 Exit
1 Source [19: SDI 0,5]
2 Name [Barometer]
3 Mode [Instant]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

```
* Sensor 6 Cfg
(Now:     0.000)
0 Exit
1 Source [19: SDI 0,6]
2 Name [Rainfall]
3 Mode [Instant]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

```
* Sensor 7 Cfg
(Now:     0.000)
0 Exit
1 Source [19: SDI 0,7]
2 Name [Hail]
3 Mode [Instant]
4 Mult [   1.00000]
5 Offset [   0.00000]
6 Reject [L  0.000],[H  0.000]
7 Log Rate [5 min], Log Mult [10]
8 Alarms
9 Data
>
```

A pre-configured iRIS configuration file for the WXT5x0 instrument is available from the iQuest website. This can be sent to the logger using iLink's configuration tool described in the next section.

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7 Using iLink's Sensor Configuration Tool

To optimise the process of maintaining multiple iRIS installations with the same (or similar) sensor configuration, iLink includes a graphical configuration tool. This allows the configuration of any the sensors to be changed, sent to the logger or saved to disk. It also supports the retrieval of sensor settings from the logger and from disk. This means that setting up new loggers is made very simple as a common configuration file can be sent to each logger.

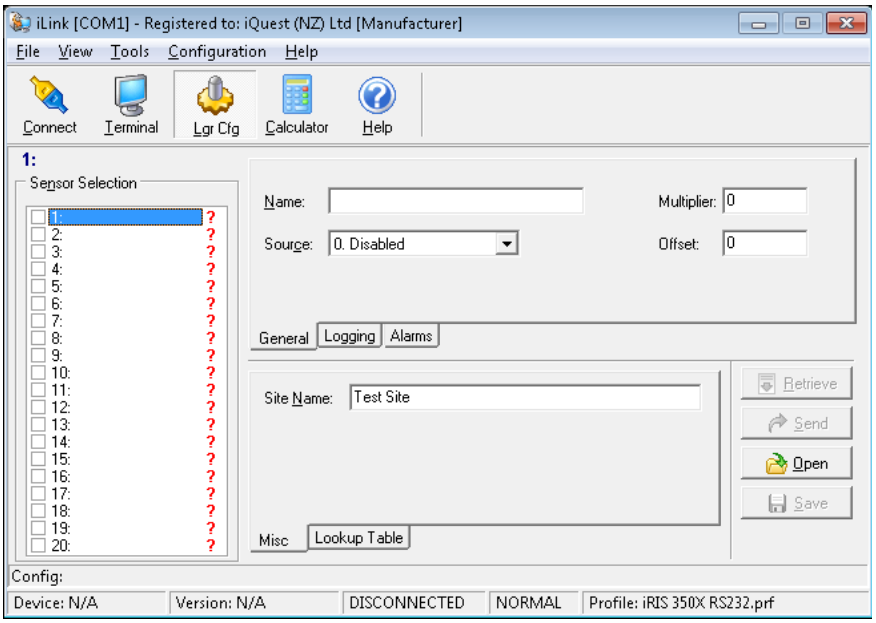
7.1 iRIS Sensor Configuration Example

This example shows how to set up a simple iRIS sensor configuration to measure water level from an SDI-12 sensor and also log internal battery voltage. This example is valid for all models

1. Connect to the iRIS using iLink.

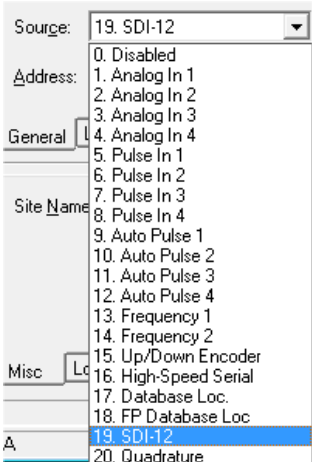
2. Invoke the iRIS configuration form by clicking the Logger Cfg tool button 

or by selecting the menu item Configuration->iRIS Logger Configuration. This will bring up the iRIS Sensor Configuration form as shown here.



3. Firstly, set up the water level sensor. Enter the sensor name "Water Lvl" (max 10 characters).

4. Now set the sensor source from the drop down list. Select source 19, SDI-12. Then enter the correct SDI-12 instrument address and variable. In our example the instrument has an address of zero (0) and we require the first value (variable 1).



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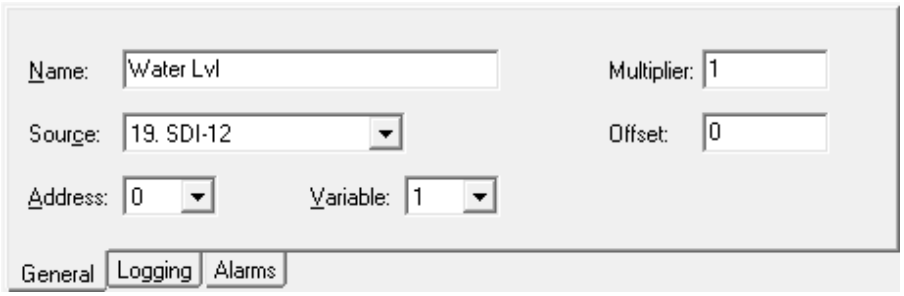
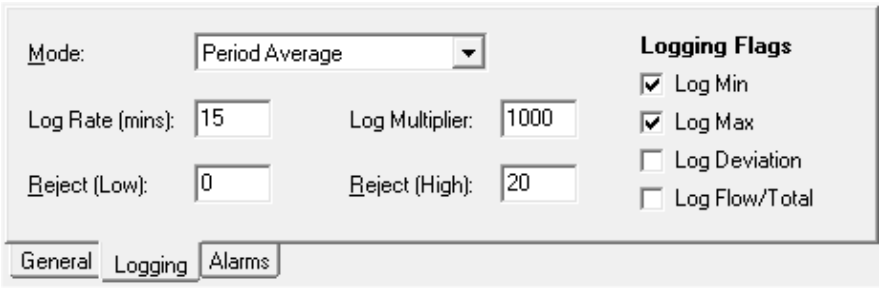
5. Enter the multiplier to scale the value. For SDI-12 instruments, the multiplier is typically 1 as the instrument itself provides an actual value in engineering units. Enter an offset if required and known at this point. More often, this is set on site to calibrate the measurement to a known reference of datum. In this case the offset can be set by using the LCD calibration screen. See Section 5.2.6.

6. The General configuration should now look like this:



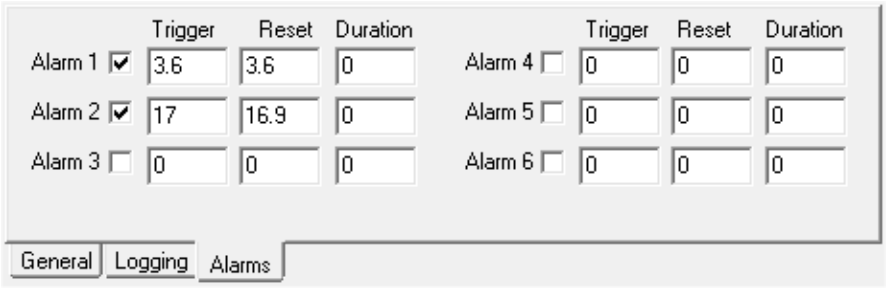
7. Now select the “Logging” tab and set up the logging parameters. In this example we are measuring averaged water level in metres so we need to set the logging multiplier to 1000 to store the value as an integer (mm). The logging rate is 15 minutes. Our hypothetical sensor generates an error value of 999.99 if it develops a fault or is unable to take a measurement. Rather than have this cause a spike in our data, we are choosing to reject values above our expected maximum of 20 metres. We also want to capture the minimum or maximum values over the period, so we enable the logging of these as well.

8. The Logging configuration should look like this:



9. Next select the “Alarms” tab. We are going to set a low level alarm at 3.5 metres and a high level alarms at 17 metres. Both alarms will have a reset differential of 0.1 metres making the reset levels 3.6 metres and 16.9 metres respectively. The alarms are set to be immediately acting, so no duration delay is required.

10. The Alarms configuration should look like this:



Note that the entry for Sensor 1 on the sensor list will now have a red question mark (?) next to it. This indicates that the configuration has been changed and has not yet been sent to the iRIS and/or saved to disk.

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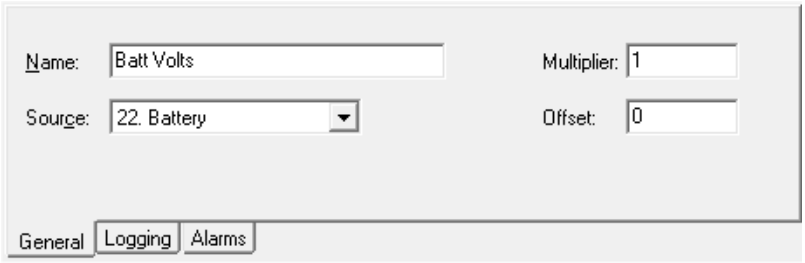
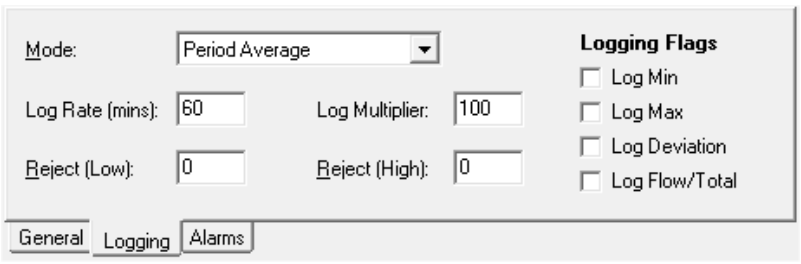
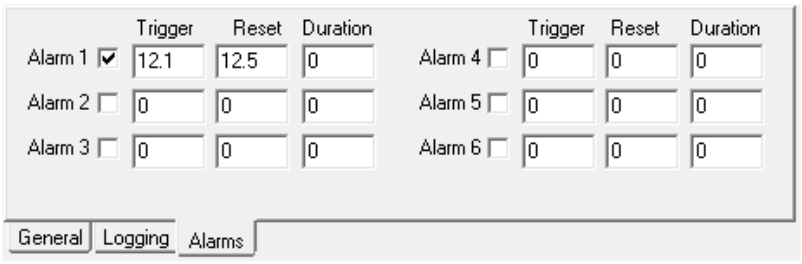
11. Next set up Sensor 2 to log the internal battery voltage. Click on the sensor 2 row in the Sensors list. The repeat the steps used for configuring the water level earlier, but in this case, select source 22 (Battery).

12. Set up the logging parameters and if required an alarm. In our example we are logging the averaged battery voltage every 60 minutes. The logging multiplier of 100 gives us two significant places in the logged data. We have set a low voltage alarm at 12.1 volts which resets when the battery rises to at least 12.5 volts again.

13. The configuration tabs should look like this:



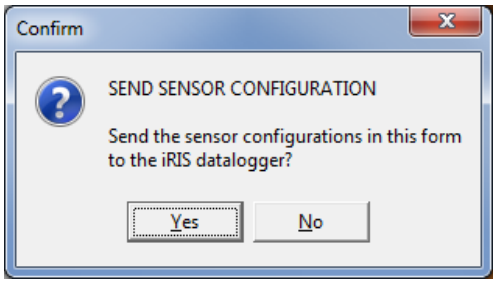




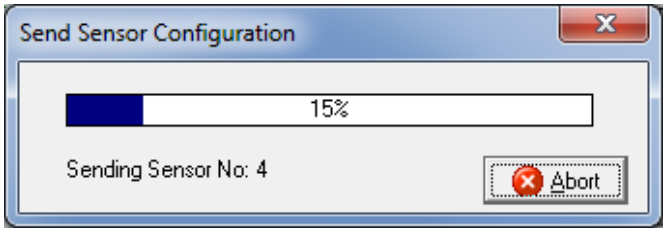
14. The sensor configuration is complete. Now enter the logger's site name in the Site Name field in the Misc panel at the bottom of the form. The site name is the text that appears on the title screen on the LCD and also in the header of downloaded data files.

15. Save the configuration to disk by clicking the [Save] button. Enter a suitable name for your configuration. Our example here will use the file name "SDI-12 Level and Battery.350X". The file can then be opened and sent to other loggers requiring the same sensor configuration at a later date.

16. Finally, send the configuration to the connected iRIS. To do this, click the [Send] button. You will be prompted to confirm that you want to send the configuration.



17. The sensor configuration will be sent in a series of blocks with a progress dialog indicating the status. The Site Name is also sent at the end of the process. The operation can be cancelled if required by clicking the [Abort] button.



18. The process is now complete. If you want to edit or save the configuration in an already configured iRIS, the reverse operation can be done by using the [Retrieve] button. The configuration can then be edited and sent back to the iRIS and/or saved to disk.

This tool only supports the configuration of sensor parameters. The communications and other settings should be done by the normal terminal method as described in Section 4.3.

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8 Analogue Input Scaling

This section explains the recommended procedure to use when scaling an analogue input (voltage or current). It makes use of the scaling calculator provided in the iLink program. However, the calculation can also be done manually using this formula. V = Input V, EU = Engineering Units (scaled output e.g. metres).

Multiplier = (Maximum EU – Minimum EU) / (Maximum V – Minimum V)
Offset = Maximum EU - (Multiplier * Maximum V)

8.1 Example: A 4-20mA Water Level Sensor

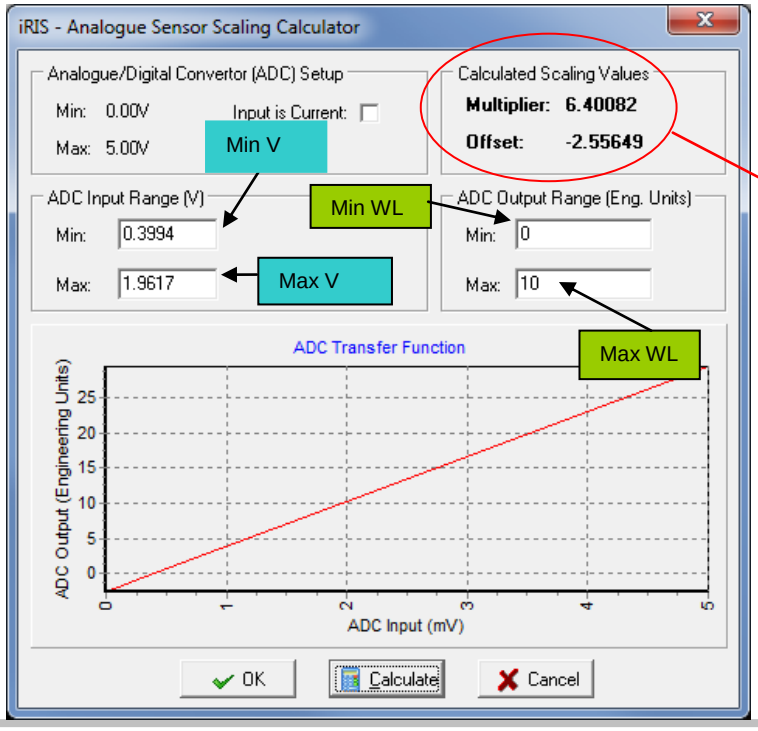
In this example, we have a water level instrument connected to the iRIS Analogue Input 1. This instrument is designed to provide a nominal 4-20mA signal for a 0-10 metre water level range. However, in the real world, most instruments are not exact and a small difference in actual signal may occur. In addition, the internal current sink resistor in the iRIS is 100Ω (theoretically giving 2V at 20mA). There is a very small reduction in resistance caused by the internal input impedance of the iRIS input channel to take into account (see Section 0 Analogue Inputs). Therefore the voltage measured by the iRIS for a given water level is slightly different.

1. Power up the installation and allow it to stabilize.
2. Set the instrument to zero water level (using a calibrator)
3. Note the actual voltage measured by the iRIS (view this on the LCD on “System Status 3” screen). See Section 5.2.5. The LCD screen example below shows 0.3994V for a 0m input level.
4. Now increase the instrument input to full scale (10m) using the calibrator. Again, note the measured voltage relating to this input level. This time it is 1.9617V for a 10m level input.

```
AI1: 0.3994 V
AI2: 0.0000 V
AI3: 0.0000 V
AI4: 0.0000 V
```

```
AI1: 1.9617 V
AI2: 0.0000 V
AI3: 0.0000 V
AI4: 0.0000 V
```

5. Using the iLink Scaling Calculator, enter the minimum and maximum measured voltages and the levels they represent in the appropriate fields. Click the “Calculate” button to generate the correct multiplier and offset parameters to use in the sensor setup menu for Sensor 1 as shown.




```
*  Sensor 1 Cfg
(Now:  0.000)
0  Exit
1  Source [1: Analogue 1]
2  Name [Water Lvl]
3  Mode [Period Avg]
4  Multiplier [ 6.40082]
5  Offset [  -2.55649]
6  Reject [L 0.000],[H  0.000]
7  Log Rate [15min], Log Mult [1000]
8  Alarms
9  Data
>
```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9 RS232 Interface Telemetry / Gateway Comms

9.1 Overview

The iRIS may be used to communicate via external telemetry devices such as data radios or modems using its RS232 port. When an external RS232 communication device is connected, the iRIS is also capable of doing “store and forward” or “gateway” communications. This feature allows data packets that are not addressed to this logger to be redirected to other iQuest devices. This chapter describes using the RS232 Telemetry function and also explains the gateway communications functionality.

9.2 RS232 Port Telemetry

If the RS232 port is to be used for telemetry, then its normal terminal/binary mode at 38400bps is disabled and the port becomes fixed to iQuest binary protocol at the user configured port speed. There are two methods of enabling the RS232 telemetry mode.

9.2.1 RS232 Only Telemetry Mode

If the iRIS does not have an internal wireless modem or else the internal modem is unused, the iRIS can be configured for “RS232 Only” telemetry mode. This mode is controlled by the iRIS software based on various actions (see table below) and the RS232 port does not need a special cable for connection to external communications devices.

In RS232 Only telemetry mode, any call-back messages will always be directed out the RS232 port. This is why telemetry mode is enabled when a user is logged in. It allows call-back testing to be done using the LCD/keypad.

Switching between telemetry and “normal” modes is controlled by the following actions:

Action	Mode
Key pressed when user is not logged in	Normal
User is logged in	Telemetry
User has just logged out	Normal
RS232 port activity in terminal or data download modes	Kept in Normal
At least 2 minutes of no activity on keypad or RS232 port	Telemetry

Table 8 – RS232 Port Telemetry Control

Mode	Protocol	House Icon	RS232 Speed
Normal	Terminal or Binary	Outline	38400bps
Telemetry	Binary Only	Filled in with ‘R’	As configured

Table 9 – RS232 Telemetry Mode Indications

9.2.2 Non-Dedicated RS232 Telemetry Mode

If the iRIS is fitted with an active internal wireless modem, then RS232 telemetry mode must be enabled by a special cable which uses the RI handshake pin to enable the telemetry mode. Refer to the diagram below.

In non-dedicated telemetry mode, any call-back messages will always be directed out the wireless port. Also, if a packet to be forwarded by the gateway is received from the RS232 port and the wireless connection is not currently active the iRIS will initiate a connection.

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In non-dedicated mode, if gateway communication is configured it will be in “bridging” mode. This is where data packets are redirected (bridged) between the wireless port (IP or CSD) and the RS232 port. This scenario is used when for example; an iRIS is used to bridge an IP connection to other loggers only reachable by radio.

The diagram below shows a typical cable required to enable RS232 telemetry in non-dedicated mode. The actual modem/radio connections may vary depending on the type of device used. The DSR line from the modem or radio is used to enable the RS232 port and the RI line enables the binary only mode and sets the port speed to the one configured in the communications configuration menu.

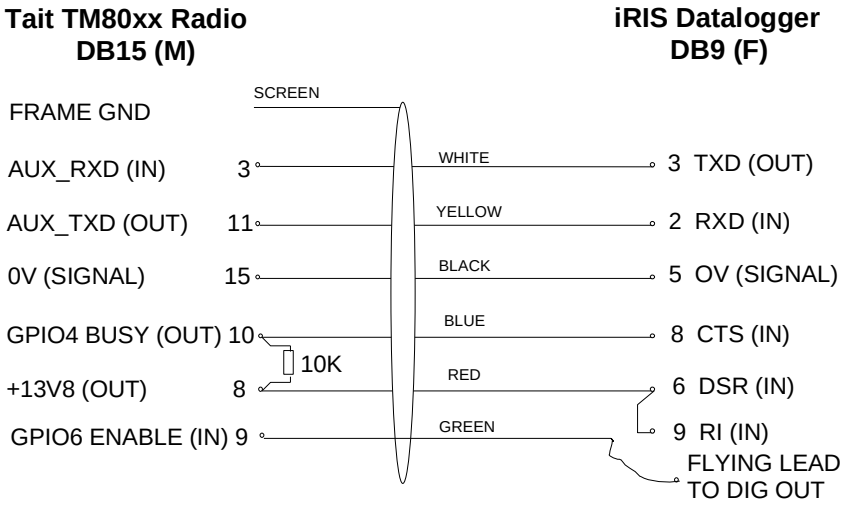

Figure 11 - Typical RS232 / Data Radio Cable

In this mode, the RS232 telemetry mode is controlled by the cable. If it is unplugged and a standard null-modem cable connected, the iRIS RS232 port will immediately switch back to normal port operation, with the usual terminal and binary communications at 38400bps. The connection icon (house) will always indicate the status of the wireless connection only.

9.3 Gateway Communication

The iRIS supports a powerful communication function - gateway, or redirected communications. Simply put, this allows an iRIS to transfer packets of data between ports, totally in the background without any programming required (beyond setting up the gateway offset.)

Uses include:

- Radio comms repeater function
- IP to radio bridging

When an incoming data packet is received from either communications port, the iRIS does the following:

- Is this message for me? If it is, then accept and process it. Gateway redirection is not needed and no further action is taken.

- Check if the iRIS has a gateway offset configured. If it does, then test the destination address in the received packet and see if it falls in the range covered by the gateway. If a match is found, then the packet will have its source and destination addresses changed (aliased) and be transmitted. In non-dedicated mode it will be sent from the other port. In dedicated mode it will be sent from the same port that the packet was received on.

- If the packet has not been used by this point then it is rejected and lost.

Note: All retries are the responsibility of the transmission originator.
The only setup required to use gateway communications is to set the gateway table offset. See Section 4.4.3.

9.3.1 Aliased Gateway explained

The iRIS uses a gateway method called ***"Aliased Gateway Communication".*** In other words, it alters the destination and source addresses of a received packet before it is redirected back out via the gateway.

The primary reason for this in a radio only situation is to completely separate radio communication paths between stations. This is to avoid a packet that has been redirected through an intermediate station being received and replied to by the far destination station at the same time. This might be due to unusual RF propagation conditions where direct communications is not normally achievable between the originator and destination stations but suddenly becomes possible.

By addressing the original packet from the originating node (usually HydroTel™) to a notional (non-existent) number, the gateway iRIS can add an offset to the address (correcting to the real address) and pass it on to the distant node. Any directly received packet will now be ignored by the distant iRIS as the address will not match.

9.3.2 Gateway Example

An iRIS, set to address 14, is installed at a hilltop rainfall measuring site. This logger is within range of a wireless network and it uses IP communications with the HydroTel™ base.

A second iRIS, which is set to address 67, is installed down in the valley at a water quality site. This site has no wireless network coverage, so a pair of low-power radios is used to link the two sites. Each radio connects to the RS232 port on its respective iRIS logger.

The hilltop site uses a special cable (see Figure **11** above) to enable non-dedicated RS232 telemetry mode because it also has wireless connectivity. As the valley site has no modem, it is set to “RS232 only” telemetry mode and it uses a standard RS232 cable to connect to the radio.

The HydroTel™ base computer (which has a communications address of 0) needs to access both iRIS loggers. To achieve this, the hilltop iRIS is enabled for gateway communication and for convenience its offset gateway is set to 1000. This means that the site will redirect any packet with a destination address between 1000 and 1099.

To enable alarm call-back from the iRIS at the valley site, its call-back address is also set to 1000 to cause the hilltop gateway logger to redirect messages to the HydroTel™ base.

The only change at the HydroTel™ base is to set the address for the valley site to 1067 in the station configuration form, rather than its actual address of 67. The address gets changed as it passes through the gateway iRIS logger as described below.

This is what happens to the data packets during a typical request→response data conversation.

- HydroTel™ sends a request packet to the valley site via IP (which has the same IP address as the hilltop site in HydroTel™). It is addressed to destination address 1067 from sender’s address 0.
- The gateway logger matches the destination address (1067) to be in its gateway address range.
- The packet’s source and destination addresses are aliased by applying the gateway offset (1000).
- The gateway logger sends the aliased packet via the radio down to the remote iRIS. It is now addressed to destination address 67 from sender’s address 1000.

- The remote iRIS processes the request and sends back its response via the radio. This packet is addressed to HydroTel™ as destination address 1000 from the valley iRIS sender’s address of 67.
- The gateway logger matches the destination address (1000) to be in its gateway address range.
- The packet’s source and destination addresses are aliased by applying the gateway offset (1000).
- The gateway logger sends the aliased packet via the IP network to the HydroTel™ base. It is now addressed to destination address 0 from sender’s address 1067.

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10 Troubleshooting

This section offers possible answers to common installation and/or configuration issues.

10.1 Can't connect to the iRIS via the RS232 port

Check that the PC application (iLink or terminal program such as HyperTerminal®) is set for the correct comms port and speed (38400bps). Also check that the iRIS is not in RS232 Only Telemetry mode. This is indicated by a solid black house icon with an 'R' symbol in it being displayed on the LCD. If it is in this telemetry mode, switch back to normal mode by pressing any key or if currently logged in, then log out by pressing Alt-Enter from a top level screen. See Section 9.2 for details on using RS232 Telemetry mode.

10.2 iRIS will not start when the battery is first connected

Check that the battery voltage is at least 12.2V. The internal battery management hardware is designed to shut the unit down when the battery becomes discharged to a certain point. It will not restart unless the battery is deemed to have sufficient capacity for normal operation.

10.3 Pulse lost when iRIS connected to other equipment

In almost all installations where an iRIS is connected in parallel with other equipment to share a common pulse input (e.g. from a flow meter) there has not been a detrimental effect, as the iRIS presents a relatively high impedance to the circuit.

However, in the event that connecting an iRIS does cause pulse failure, try removing the debounce selection link for the appropriate input. This sets the input to electronic switching mode, even if the actual pulse source is a clean contact (reed switch or similar). See Section 3.3.5 for details on the digital inputs.

10.4 Unable to connect to an IP network

SIM Card: Check the SIM card is active and enabled for IP connectivity service.
APN: The unit must be configured for a valid APN that must also match the SIM account APN.
Signal: The iRIS will not attempt to connect if the RSSI is 0 or < -113dBm. Use a higher gain antenna if the signal strength is marginal.
IP Settings: The iRIS will not attempt to connect unless both the primary and secondary base settings are defined. (IP addresses and port numbers are non-zero). If the secondary base is not used, set it to the same values as the primary base.

See Appendix I for a list of the network settings for the iQuest APN or iQuest Global Data Network.

10.5 iRIS will not respond to SMS requests

Account: Check the account is active and the SMS service is enabled.
Power Mode: If full power save is selected, the wireless modem is shut down.
Connection: If the iRIS is connected on an IP session, the SMS feature is unavailable. Use a scheduled IP connection to minimise the time that SMS is unavailable.
Voice Call: If an iRIS 350V is connected on a voice call, the SMS feature is unavailable.

10.6 iRIS 3x0V answers a voice call, but no sound is heard

If the iRIS is currently connected to the wireless network with an IP link the iRIS voice processing function is disabled. However the internal modem may answer the incoming call independently but have no audio available.

Set the IP connectivity using the scheduler so that it has a high availability for voice (short on-line sessions).

10.7 Logged data limits at a value like 32767

The iRIS stores data as a signed 16-bit integer value which has a range from -32768 to +32767. To adjust the actual measured value for storage, a logging multiplier is applied. If the measured value multiplied by this factor exceeds 32767, the stored value will limit at that point. Note that the result may be a number like 32.767 after it has been scaling by the unloading application (HydroTel, iLink etc).

See Section 4.4.9 for details on using the logging multiplier.

10.8 Unable to access terminal menu

If the security code has been enabled and this is unknown, then access is not possible. Please contact the person responsible for setting the code in the first instance. The code is set by an authorised user using iLink.

However, if the security code is known and yet access is still denied, check the case of the entry is correct. E.g. Caps Lock key is not on. The code is case-sensitive and must match exactly...

See Section 4.2 for details on the security code.

10.9 Digital Output activates when user is logged on

This indicates the output is set to a scheduled mode with special features enabled This mode is to enable easy sensor calibration or radio communication testing when the sensor or radio is controlled by a scheduled digital output. Otherwise the person on site would have to wait until the next scheduled operation to be able to perform the test.

11 Appendix A – Specific Information

11.1 General Characteristics

The iRIS 350X is supplied in an environmentally sealed (IP66) enclosure constructed from a special corrosion-resistant aluminium alloy that is finished in a hard-anodised coating. This provides a very high degree of mechanical strength and EMI shielding, and enables completely stand-alone mounting in outdoor situations. The unit comes standard with an integral 12V gel-cell battery, membrane keypad and a 4 lines x 19 characters (plus icons) LCD.

The iRIS 350X supports a maximum of twenty external sensors (1-20). Sources for these sensors may be chosen from physical digital or analogue inputs or virtual sources (via serial communication or calculations). Sources may also be from internal measurements (battery voltage, supply voltage, temperature and RSSI). Each sensor has six associated alarms, each with separate trigger and reset levels. Each alarm also has a duration, which is used to delay the alarm trigger for analogue inputs and to determine the time over which pulse input counters should be totalised (rainfall etc).

Data from all enabled sensors are logged in a four word (8 byte) compressed format which includes full date and time to fractions of a second.

The iRIS 350X supports SDI-12 communication with a range of industry standard intelligent sensors. Refer to Appendix F – SDI-12 for more details on the SDI-12 interface.

A variant of the iRIS 350X which is designated the iRIS 350XV offers voice annunciation of sensor values using the voice bearer of the wireless service. Refer to Appendix C – Voice Annunciation (iRIS 350XV) for more details on the voice model.

The iRIS 350X supports the connection of a proprietary serial camera, the iRIS-CAM. This enables the iRIS to capture colour images which can be unloaded in the same way as logged data. Due to resource limitations, the iRIS 350XV is unable to support the iRIS-CAM in conjunction with the voice feature.

Figure 12 - iRIS 350X External View

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11.2 Technical Specifications

Dimensions:	117mm x 162mm x 67mm (4.60in x 6.37in x 2.64in) (Excluding glands and mounting plate)
Mass:	1450g (3.19lb) with gel-cell battery fitted.
Power Supply:	Internal 12V @ 0.8A/Hr rechargeable sealed lead acid battery. Can also connect an external regulated 12V dc power supply or rechargeable sealed lead-acid battery.
Charger Supply:	External 15-30Vdc supply. Supports a directly connected solar panel (no regulator).
Power Consumption:	Less than 6mA @ 12V in idle mode. Actual current consumption is dependent on power management mode, wireless modem state and I/O configuration.
Comms Interfaces:	1x RS232 DB9, 38,400 bps, DTE configuration. 1x Integral multi-band wireless modem or 1x Plug-in comms adaptor E.g. Ethernet, satellite etc. Requires PCB Rev 1.2+
Digital I/O:	4 x Digital Inputs/Outputs. Each channel configurable as either an input or output. Digital Input Mode: - 30Vdc maximum input, switch to 0Vdc to activate. - Link selectable for either mechanical (<20Hz) or electronic (<5kHz) switching. Digital Output Mode: When set for output, the channel can be either: - Switched 12V out (max 100mA) or - Open-drain pull-down (max 100mA @ 30V)
Analogue I/O:	4 x 16 bit uni-polar analogue inputs. Range 0 – 5.000V. Input impedance 98kΩ. Referenced to 0V common. Internal measurements available for monitoring are: • Battery Voltage • Supply Voltage • Internal Temperature (°C or °F) • Received Signal Strength (RSSI or RSCP) • Link selectable for either voltage (0-5V) or current (0-20mA) mode. Integral current mode resistor value 100R.
SDI-12 Interface:	SDI-12 hardware interface that fully complies with the SDI-12 electrical standard. Software support to SDI-12 standard 1.2.
Logging Memory:	Non-volatile 8MB flash storage of 1,085,476 time/date stamped data points. Circular buffer mode (overwrites oldest data when memory full). A typical site with 2 parameters logged every 15 minutes plus battery voltage logged hourly will give 3.3 years of storage before data overwrite occurs.
Audio Memory:	***iRIS 350XV only***. Non-volatile 8MB flash storage of PCM audio files. Total cumulative playtime 12 minutes at 11.025kHz sampling rate.
Clock/Calendar:	Non-volatile with user replaceable lithium back-up battery module. Y2K compliant with leap year recognition. Accurate to +/-20 secs month, trimmable via a configuration register.
Mounting:	4 x M4 (3/16”) blind mounting holes in rear of case. 4 x 16mm (¾”) compression glands for power supply and I/O cabling access.
Environmental:	Storage Temperature: -20°C - +85°C. (-4°F - +185°F) Operating Temperature: -10°C - +70°C. (14°F - +158°F) Enclosure sealed to IP66 with gasket and glands.

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11.3 Mounting

The iRIS can be mounted by installing suitable screws through the mounting pillars which are exposed when the lid is opened. The recommended mounting screws are M4 machine screws or Twinfast® wood screws.

It is very important that the four screws retaining the lid are tightened firmly after installation to maintain the IP66 rating of the enclosure.

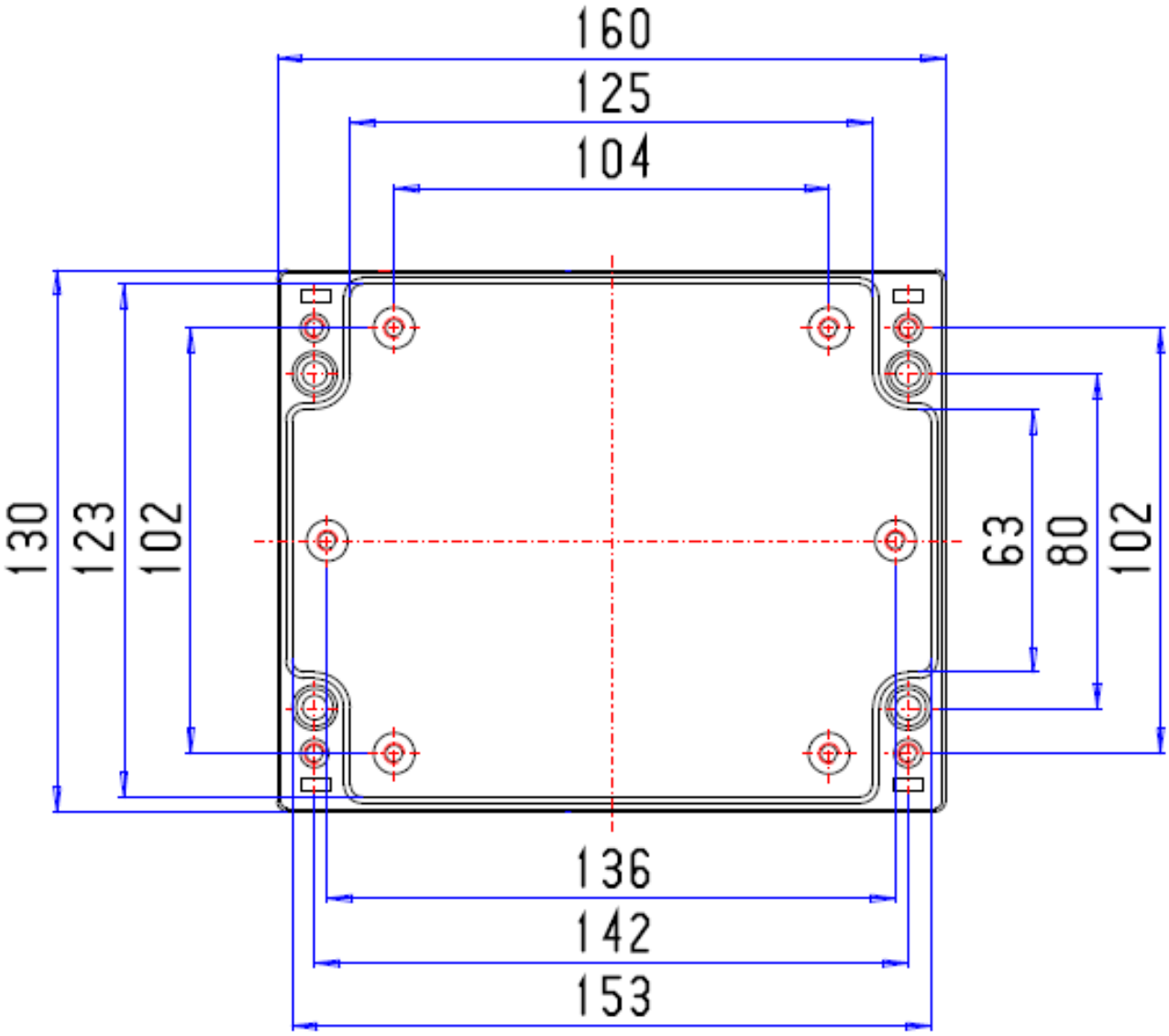

Figure 13 - Mounting Diagram

The mounting holes are on 142mm (5.11in) width by 80mm (3.2in) height centres.

11.4 Antenna Connection

The iRIS 350 has an industry standard SMA connector which protrudes through the bottom edge of the enclosure lid.

In areas of good signal strength, a small “stubby” or omni-directional type antenna will suffice. In areas of more marginal coverage, the antenna should an external high gain type such as a Yagi, via appropriate low-loss high frequency coaxial cable and male SMA connector.

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12 Appendix B - Derivation using a Lookup Table

12.1 Overview

The iRIS supports a single lookup table for use in calculating derived data using the scaled value from Sensor 1 as a source. The table file format is identical to that used by HydroTel™.

The lookup table must be contained in a text file with a .tbl extension and only integer values are permitted. The format of the table is that of 'paired' values. An excerpt of a sample table is shown below:

1000	Recorded value from attached physical sensor
21600	Value to be inserted for derived sensor
1010	Recorded value from attached physical sensor
22000	Value to be inserted for derived sensor

1020

22300

1030

22600

1040

22900

1050

23200

1060

23600

The iRIS deals with recorded values that fall between table entries by using simple linear interpolation. Thus for the table above, if a value of 1005 is recorded, the associated derived value will be calculated as:

$$21600 + (22000 - 21600) * \frac{(1005 - 1000)}{(1010 - 1000)} = 21800$$

The input value from Sensor 1 must be suitably scaled for the integer format of the table. Typically water level will be in millimetres. If it is in metres, a multiplier of 1000 can be applied in the derived sensor's configuration.

Also, if the input value is out of the range of the table, the result is an "error" value of -9999.

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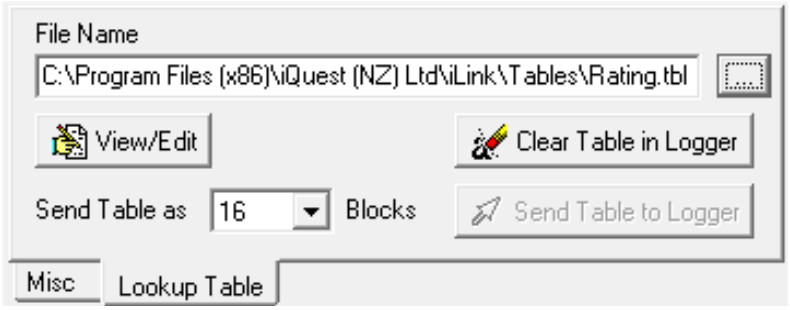
12.1.1 Loading a Table using iLink

The iRIS will support tables ranging from 2 pairs up to 320 pairs.



The iRIS logger is able to store a single lookup table for performing derived sensor calculations. For example, it may be necessary or useful to have the flow rate derived from a stage level sensor within the logger and utilized as a separate value. The lookup must be in the correct format as described above.

File Name
Enter the file name of the lookup table here. It must have a .tbl file suffix.

Num Blocks {16,32,64}
Specify the size of the lookup table here. This is necessary so that the iRIS can allocate the correct amount of memory for the table prior to the upload.

[Browse]
Click here to open a 'File Open' window from which you can browse to the file containing the required lookup table. By default, iLink lists files with a .tbl extension, and looks in the /iLink/Tables folder for them.

[Clear]
Click here to clear the current lookup table from the iRIS. Confirmation is required as a precaution before the action is carried out.

[Send]
Click here to upload the table that is specified. Confirmation is required before the action is carried out. While the table is being uploaded, the status bar will indicate the progress as the blocks (segments) are loaded. If the specified table contains more blocks than that specified in the 'Num Blocks' setting, the extra blocks will not be uploaded.

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13 Appendix C – Voice Annunciation (iRIS 350XV)

The iRIS 350X can be supplied with a voice annunciation feature. In this case it is then allocated the designation, **iRIS 350XV**. Typically the voice annunciation feature is used to play back the current values of all enabled sensors when the unit is called up from a telephone.

To maintain high quality, natural sounding audio, including support for almost any language, the iRIS 350XV uses standard PCM (Pulse Code Modulation) sound files. These are stored in the unit in a dedicated flash memory device. The files are standard 8-bit, mono, 11.025kHz wave files and loaded into the iRIS 3x0V using the Audio Manager function in iLink.

All iRIS 350XV units are supplied initially with a default set of sound files pre-loaded and these can be used/modified/replaced as necessary by following the directions in the later part of this section.

To optimise the speed of operation against the available memory, the audio file storage has been divided into four "partitions", each able to hold a fixed number of files that can be easily indexed by the iRIS 350XV controller. The partitioning has been designed to allow sufficient space for future bilingual voice support. Currently, only the first half of each partition is used. The second language option will use the second block of messages in each partition. E.g. Partition 0, Messages 1-22 are for language 1, Messages 23-44 will be for language 2.

Partition	Function	Max File Length	Number of Files
0	Standard Sounds	1 second	44
1	Sensor Units	2 seconds	18
2	Sensor Names	3 seconds	18
3	Site Name / Misc Instructions	5 seconds	12

Partition 0
This partition holds the standard sound files for the digits 0-9, a decimal point and minus. These are used to create the reported measurement values. This partition should be loaded with the appropriate files containing the local words for the following numeric values:

Message 1:	"One"	Message 11:	"Point"	Message 21:	spare
Message 2:	"Two"	Message 12:	"Minus"	Message 22:	spare
Message 3:	"Three"	Message 13:	spare		
Message 4:	"Four"	Message 14:	spare		
Message 5:	"Five"	Message 15:	spare		
Message 6:	"Six"	Message 16:	spare		
Message 7:	"Seven"	Message 17:	spare		
Message 8:	"Eight"	Message 18:	spare		
Message 9:	"Nine"	Message 19:	spare		
Message 10:	"Zero"	Message 20:	spare		

Partition 1
This partition holds the specific sound files for the units of the nine sensors. For example, if Sensor 3 is measuring air temperature in °C, then the file loaded into Partition 1, Message 3 should contain the local language phrase for "Degrees Celsius".

Messages 1-9: Sensor Units for Sensors 1-9 respectively.

Partition 2
This partition holds the specific sound files for the measurement names of the nine sensors. For example, if Sensor 3 is measuring air temperature in °C, then the file loaded into Partition 2, Message 3 should contain the local language name for "Air Temperature".

Messages 1-9: Sensor Name for Sensors 1-9 respectively.

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Partition 3
This partition holds the specific sound files for the site name and specific instructions or information relating to the site.

Messages 1-6: Miscellaneous Site Specific Files e.g. Site name, disclaimers etc.

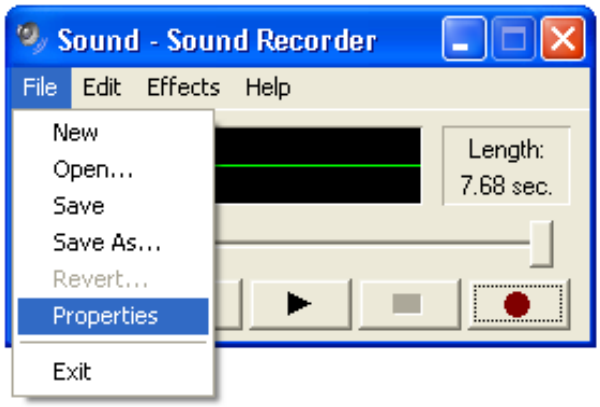
13.1 Recording Wave Files Using Sound Recorder

Any suitable sound recording software can be used to record and prepare the sound files, as long as the software is capable of converting/saving the file in the correct format. The required format is:

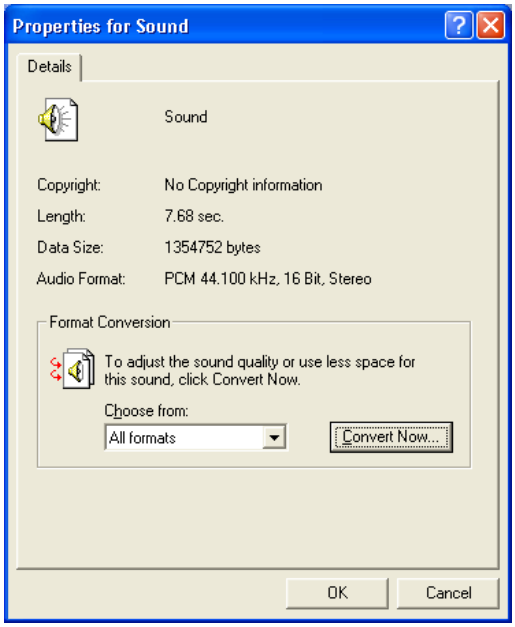
PCM (Pulse Code Modulation), 8-bit, mono, 11.025kHz sample rate

This format is available in the standard Windows Sound Recorder and the following screen shots detail how to record such a wave file using Sound Recorder.

1. Open Sound Recorder, click on the File menu and select Properties:



2. Click the 'Convert Now' button:



3. Select the Name as "Telephone Quality" from the drop-down list and check that the Format is "PCM". If this is not the case, select it from the drop-down list.

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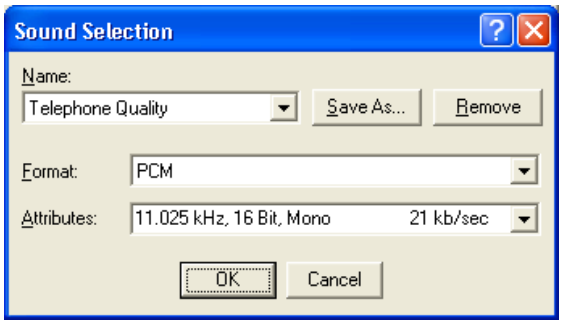
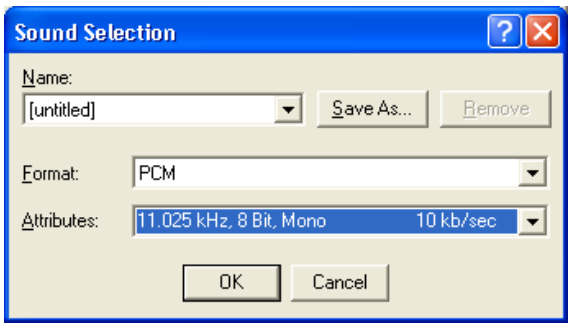


4. Change the Attributes by selecting '11.025kHz, 8 bit, Mono 10 kb/sec' from the drop-down list.



The Name will change to [Untitled]. There is no need to be concerned about this.

4. Click on OK to close the dialog box, and then click on OK again to close the properties box.
5. Click the Record button  to begin recording your message.

For multiple messages, it is often more efficient to record several in one "master" message with appropriate gaps, then cut and trim the individual messages from that original file. See 9 below.

7. When you have finished recording, click the Stop button. 

8. It is a good idea to play back the message to check the quality and clarity of the sound.

9. Usually, you will need to trim the sound file so that it fits in the designated partition and message slot (refer to the table above for the maximum permitted message lengths). This can be done by deleting a section of the file at the beginning and end of the message.

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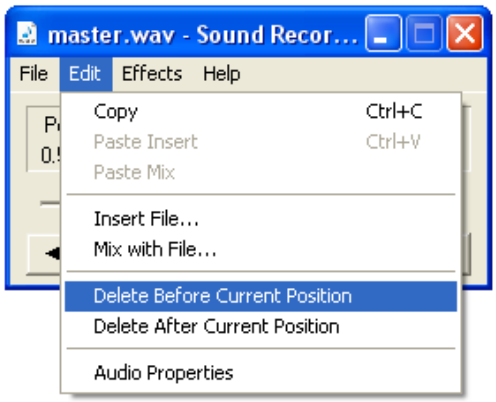
10. To delete a section of the message at the start, play the message back until you reach the point that you wish to delete up to. This can be fine-adjusted by dragging the slider bar if necessary. Then click on the Edit menu and choose 'Delete before current position'. You will be asked to confirm the deletion. Click 'OK' to confirm and the portion of the message up to the current point will be deleted.

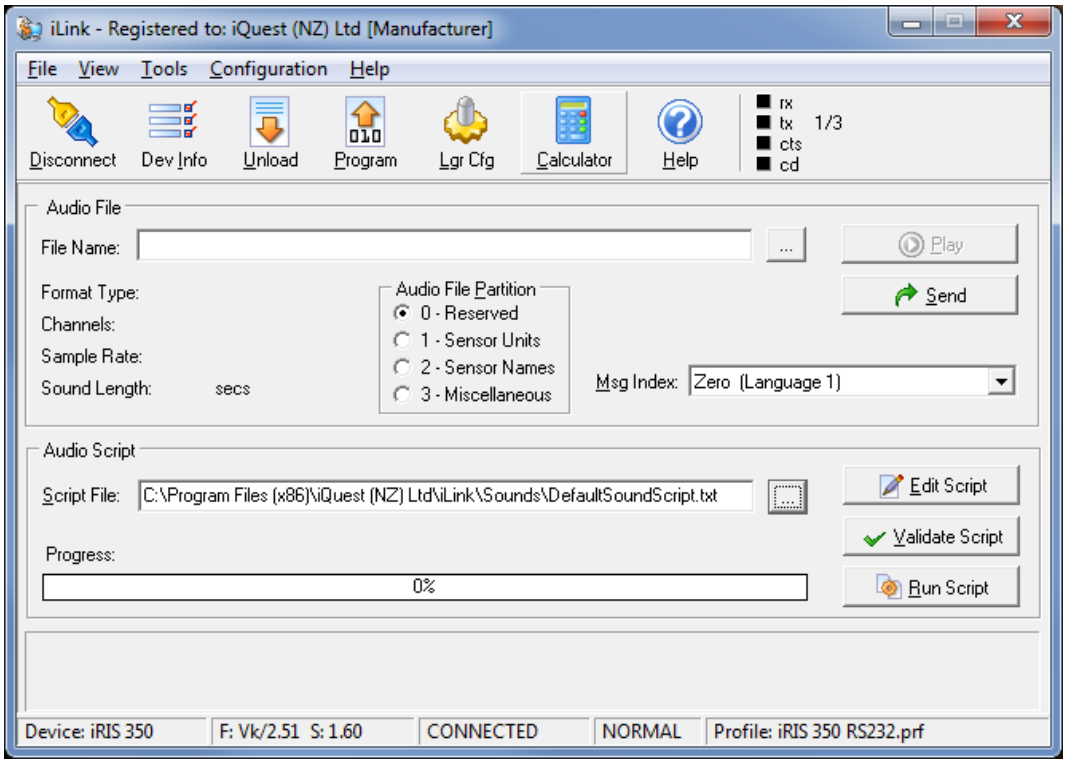


11. This same process can be used to delete a section from the end of the message, but using 'Delete after current position' instead.

12. The file can then be saved, ready for uploading to the iRIS 350XV, by clicking on the File menu and selecting 'Save As'.

13.2 Loading Wave Files into the iRIS

iLink incorporates an Audio Manager form which is designed for uploading single or multiple audio files to an iRIS 3x0V. The Audio Manager is accessed by selecting **[Tools][Advanced][Audio Manager]** from the main menu and is shown in the following screenshot:



The page is split into two separate areas, Audio File and Audio Script. The Audio File settings are used to playback and/or upload individual files to an iRIS 350XV. The Audio Script settings are used to validate and/or upload multiple sound files.

13.2.1 Audio File Settings

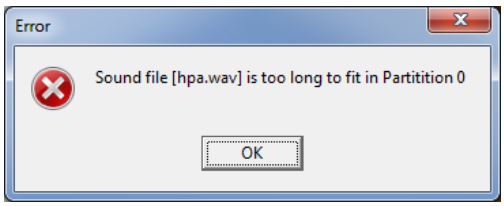
The Audio File panel is used to upload or playback a single audio file. First of all select the Audio File Partition and Msg Index of the audio file you are uploading. For details on the partitions and message indices, refer to the beginning of this section.

Then select the file that you wish to playback and/or upload to the iRIS 3x0V:

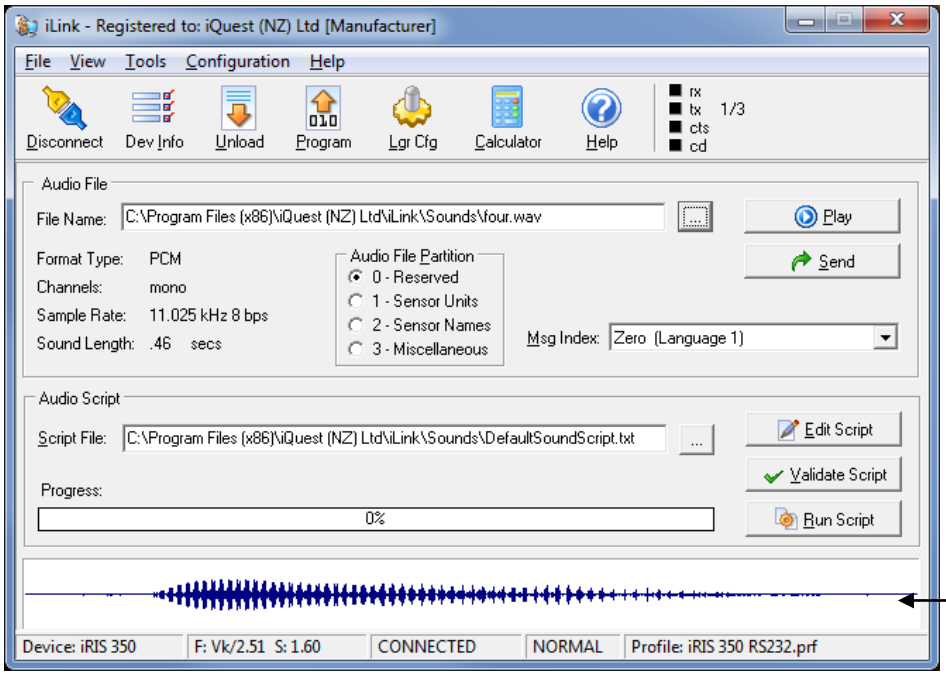
Either type a file name (with full path, e.g. c:\sound files\intro.wav) or click the browse button [...] and select the required file.

The default path for the sound files is the Sounds folder under the root iLink folder. C:\Program Files\iQuest (NZ) Ltd\iLink\Sounds

When you specify a file, iLink will verify that the audio file is small enough to fit in the Partition/Index combination that you have selected. If it is incompatible, an error message will be displayed giving details of the error. An example message is shown here, indicating the file is too large to fit into the selected partition.



Once you have selected a file, the waveform of the audio file is displayed graphically in the panel at the bottom of the screen. This is the case even if the file has been checked and found to be incompatible. This graphical display is also useful for determining the relative level (volume) of the file. For best results, the peaks of the sound waveform should just approach the top and bottom of the graph without clipping.



To playback the file click on the [Play] button (you will need to ensure you have speakers connected to your PC for this function, and that the volume control is adjusted to a suitable level). To upload the file to the iRIS 3x0V, click on the [Send] button. While the file is uploading, all buttons except the [Abort] button will be disabled. A message will be displayed when the file upload is complete.

This button will only be available if an iRIS 350XV is currently connected – the button will be 'greyed out' if you are working in offline mode.

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13.2.2 Audio Script Settings

The Audio Script panel is used to edit, validate and upload audio scripts. An audio script is a list of audio files together with an associated partition and message index number. For information on partitions and message indices refer to the beginning of this Section.

An example audio script, DefaultSoundScript.txt is included with the iLink installation and can be used as a base template for creating other script files. The DefaultSoundScript file contains the following entries:

```
0,1,zero          2,1,waterlevel
0,2,one           2,2,pause
0,3,two           2,3,pause
0,4,three         2,4,pause
0,5,four          2,5,pause
0,6,five          2,6,pause
0,7,six           2,7,battery
0,8,seven         2,8,solarvolts
0,9,eight         2,9,temperature
0,10,nine         3,1,site
0,11,point        3,2,pause
0,12,minus
1,1,metres
1,2,pause
1,3,pause
1,4,pause
1,5,pause
1,6,pause
1,7,volts
1,8,volts
1,9,degc
```

Each row contains three settings:

- The partition number
- The message index
- The name of the sound file

The sound file name does not have the .wav extension included, to simplify the script.

The first line in the DefaultSoundScript file shown here indicates that a file named zero.wav should be loaded into partition 0, message index 1.

All the sound files to be used in the script must be located in the 'Sounds' subfolder located in the iLink application folder.

The script file can contain as few or as many entries as required. Only locations (partition number and message index) that you wish to modify need to be included in the script file. In the example file shown above, messages 1-12 are updated for partition 0 along with messages 1-9 for partition 1, messages 1-9 for partition 2 and messages 1 and 2 for partition 3. All other locations are left unchanged within the iRIS 350XV, i.e. any files that are currently stored in these locations will remain after the script has been run.

In practice it is useful to create a 'standard' script file that lists the locations and audio files for the digits, and then create a series of 'site specific' scripts that contain the locations and wave file for the sensors, units and site name etc.

Validating Audio Script Files

Once you have selected an audio script, you should click the [Validate Script] button to verify that the script does not contain any errors. Possible errors might include syntax errors, the wrong number of parameters on a line, a wave file that does not exist or a wave file that is incompatible with the specified partition. As iLink scans the script file, each of the specified wave files is selected into the Audio Panel (see earlier) and scanned for compatibility. The associated waveform is also displayed in the bottom panel as each file is processed. Once the verification process is complete, a message box will be displayed indicating either a successful scan, or the first error encountered.

If an error is encountered, the details are displayed and will need to be corrected before the script can be run.

Editing Script Files

Script files are just plain text files and so they can be edited from any suitable text editor such as Windows™ Notepad. If a script file has been selected in the iLink Audio Manager, clicking on the [Edit Script] button will launch Notepad with the selected script file loaded, ready for editing. Remember to save any changes before closing Notepad and returning to the Audio Manager.

Running an Audio Script File

Once a script file has been selected and verified, click on the [Run Script] button to execute the script which will upload each of the specified audio files to the iRIS 350XV. As each line of the script is processed, the top panel (Audio File Panel) reflects the current audio file, partition and index number, and the bottom panel displays the audio file waveform in a graphical format.

When the script has completed, a message will be displayed confirming that the upload procedure is complete.

13.2.3 Uploading Audio Files over a Remote Connection

It is possible to upload audio files to an iRIS 350XV that is connected to iLink over an IP or even a radio or other low-speed link. However due to the potentially large file sizes involved, it is highly recommended that all audio uploads are carried out with the logger connected directly to the PC via the RS232 port.

Also, if communication to the logger is lost during a script-based audio upload, the results may be indeterminable as files may be only partially loaded so remote uploads should be carried out with caution and only considered where a local connection is absolutely not possible.

14 Appendix D - Using an iRIS-CAM Camera

14.1 Overview

The iRIS-CAM is a camera accessory for the iRIS 350X datalogger. It is supplied in an environmentally sealed (IP66) enclosure constructed from a special corrosion-resistant aluminium alloy that is finished in a hard-anodised coating. This provides a very high degree of mechanical strength and EMI shielding, and enables completely stand-alone mounting in outdoor situations. The enclosure is filled with epoxy resin and the lens is silicon greased in place, which means the potential for water ingress is extremely low.

When connected to an appropriately configured iRIS data logger, images can be taken, stored and then unloaded (at regular intervals) via any of the communication channels available to the iRIS (e.g. IP or RS232).

14.2 Specifications

SIZE:	162mm x 116mm x 65mm (4.60in x 6.37in x 2.64in) (WxHxD)
CONNECTORS:	6 way rectangular connector on the end of 5m of shielded PVC cable.
MASS:	300 g (10.6oz)
POWER SUPPLY:	3.3V d.c +/- 10% (powered via cable from iRIS)
RESOLUTION:	Selectable 80x60, 160x128, 350x240 or 640x480 pixels, JPEG format, 24-bit colour
STANDARD LENS:	F2.8 Focal length 4mm Integral IR filter
ENVIRONMENTAL:	Operating: -10 °C to +70 °C (14 °F to +158 °F) Storage: -10 °C to +85 °C (14 °F to +185 °F) Enclosure sealed to IP66

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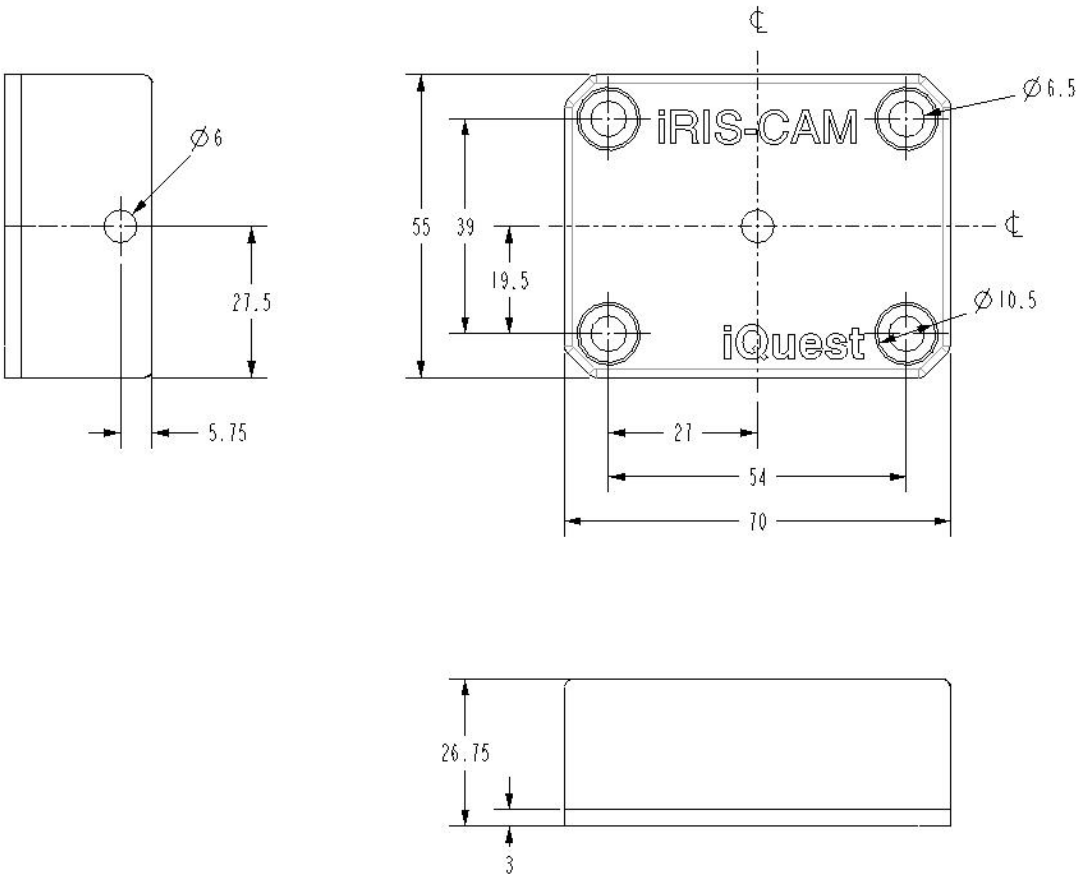
14.3 Mounting

This can be achieved with the use of the four M6 Allen Key® bolts or other suitable hardware such as wood screws. The diagram below shows the overall dimensions and position of the mounting holes for the IRIS-CAM. The correct orientation is shown in the diagram, where the engraved writing is the right way up. The cable extends from the left side of the enclosure when viewing the camera from the front.



Due to the lens's small aperture it can be susceptible to image quality degradation should a droplet of water land on the lens (the effect of which is to create a second lens, severely distorting the image). To minimize the effects of rain, provide the camera lens with a rain shield and position the camera so that it points down and away from prevailing weather.

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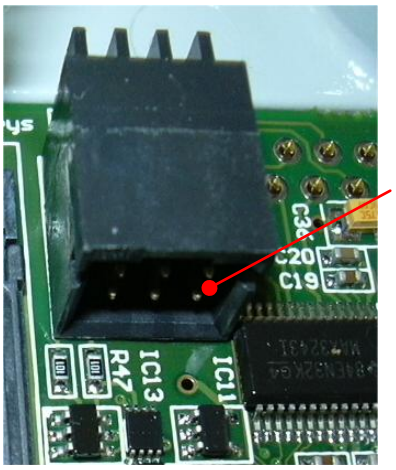
14.4 Connecting the iRIS-CAM

Connecting the camera to the datalogger is a simple process. First disconnect all power to the logger then feed the camera cable through the gland. Next connect the iRIS-CAM 6 way connector to the camera port on the iRIS circuit board. This is located next to the SIM card carrier on the iRIS. Finally tighten the gland and re-power the logger.



iRIS-CAM 6 way Connector on iRIS 350X

The easiest way to commission the iRIS-CAM is to connect it to the USB port of a laptop or desktop PC. This allows quick and repetitive collection of images from the camera, enabling quick focusing and alignment of the camera.

It is important to install the Windows® iRIS-CAM USB adapter drivers before connecting the camera to the PC.

14.5 Installing PC Based Software & USB Drivers

The following list of steps will install the iRIS-CAM commissioning software and the Windows® USB drivers for the iRIS-CAM adaptor.

1. Obtain the installation package from iQuest.[1]

2. For the CD distribution:
   a. Insert CD into PC's CDROM drive. If the installer does not automatically start, then run it manually from d:\ iRISCAMInstaller.exe (where d:\ is the CDROM drive letter).
   b. Click on **Install iRIS-CAM** button and follow the prompts.

3. For a Web download:
   a. Download the iRIS-CAM windows software installer package from www.iquest.co.nz
   b. Run the iRISCAMInstaller.exe program and follow the instructions.

4. Once installation of the iRIS Camera Software is complete and the installation program has been closed, install the USB drivers by:
   a. Run the installer from Start->All Programs->iRIS-CAM->USB Driver Installer.
   b. Click **Install** button.

   If you are prompted with the message saying the software has not passed Windows Logo Verification, please ignore and click the **Continue Anyway** button.

[1] Software can be obtained from CD or the iQuest website: www.iquest.co.nz

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14.6 Connecting to the PC

Follow the simple list of steps to connect the iRIS-CAM to a laptop and then initiate and download images.

1. Connect the iRIS-CAM's 6 way connector to the USB adaptor (disconnect from iRIS if required).
2. Connect the USB Cable to the USB adaptor and then connect the other end to a USB port on the PC.

It is important to install the Windows® iRIS-CAM USB adapter drivers before connecting the camera to the PC see section 14.5.

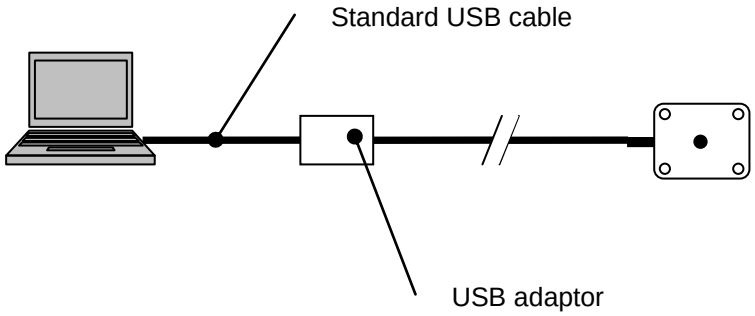
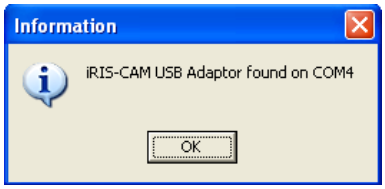


Figure 14 Connecting the iRIS-CAM to a PC.

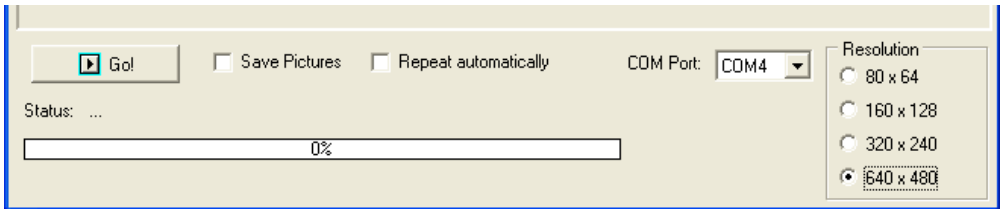
3. When the cables are connected for the first time a popup box will appear on the PC indicating an iRIS Camera Adaptor has been found and a second box will appear named **Found New Hardware Wizard.**

    a. When prompted whether to search online for drivers choose **No, not this time** option and press the **Next** button twice. If you are prompted with the message saying the software has not passed Windows Logo Verification, please ignore and click the **Continue Anyway** button.
    b. Click the **Finish** button.
    c. Repeat steps a & b for the iRIS Camera Virtual Port.

4. Start the iRIS-CAM Commissioning Software (Start->All Programs->iRIS-CAM->iRIS-CAM). This will bring up a box should popup indicating the USB adaptor has been found. Click **Ok** button to proceed.



5. Select the resolution and the repeat function as desired.



6. Click the Go button to start downloading images.

To stop the automatic repeat feature, uncheck the "Repeat Automatically" checkbox.

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14.7 Focusing

Focusing of the camera can be achieved by screwing the lens clockwise or anticlockwise when viewing the camera from the front. The camera is factory set to for midrange focus.

- Anticlockwise rotation (or screw outwards) focuses on near objects.
- Clockwise rotation (or screw inwards) focuses on distant objects.

14.8 iRIS Configuration

Once the camera has been installed and commissioned using the PC interface the iRIS needs to be programmed and configured.

14.8.1 Installing iRIS Software for Camera Support

Installation of iRIS datalogger based software is achieved by using the iLink software package on a PC connected to the logger via a null-modem cable. For details on how to upgrade the firmware and/or software lease refer to Appendix E – Upgrading Firmware/Software. The only requirement for camera support is to select the correct version for Program Bank 2. This is the file with the identifier "Camera" instead of the standard variant which has the identifier "Std".

e.g. **iRIS350X_Cell(W)_Camera_zzz_2.irs** is the correct version for camera support on a cellular version of the iRIS 350X.

14.8.2 Configure the Camera on the iRIS

As with a standard iRIS data logger all configuration is achieved through a terminal session with the logger from a PC. This is done by connecting a PC to the logger with a null modem cable and connecting to it with a terminal program like HyperTerminal. The list below describes the configuring of the settings that relate to the operation of the camera.

Camera Menu

1. If not already connected, connect to logger using HyperTerminal with communication settings 38400,n,8,1.

2. When the main menu is shown choose menu item `9 Camera`, which will display the following menu.

```
* Camera Cfg
0 Exit
1 Resolution [7: 640x480]
>
```

3. Use menu item `1 Resolution` to adjust the resolution that pictures will be taken at when in scheduled mode. Options are:

   0: Disabled
   1: 80x64
   3: 160x128
   5: 320x240 (QVGA)
   7: 640x480 (VGA)

4. Select menu item 0 to return to the main menu.

There are four ways of taking an image:

- Scheduled – This method uses the Camera Schedule to take pictures at regular intervals. If external illumination is required a digital output can be separately configured in schedule mode to power the light source.
- Alarm – If enabled, the camera will take a picture when the iRIS goes from having no active alarms to one or more being active. To rearm this function, the alarms must return to normal, so this works best when there is only a single alarm configured in the system.
- Remote – Use HydroTel™ to start a picture capture. Refer to the HydroTel documentation on how to setup and use this feature.
- By a logged in user initiating a test call in from the communications LCD screen. This will take a picture and automatically connect to the HydroTel base and have it retrieve the image(s).

Scheduled and Alarm Picture Capture Settings

1. Connect to logger using HyperTerminal with communication settings 38400,n,8,1
2. When the main menu is shown select item 9 which will display the camera menu.

```
* Camera Cfg
0 Exit
1 Resolution [7: 640x480]
2 Use Alarms [No]
3 Start Time [0525]
4 End Time [1959]
5 Interval [60 min]

>
```

3. The important settings are as follows

Menu item 1:	Set the desired resolution.
Menu item 2:	Set this to 1 (Yes) if a picture should be taken on an alarm.
Menu item 3:	Start taking images at this time (24 hour clock).
Menu item 4:	Stop taking images at this time (24 hour clock).
Menu item 5:	How often the images are taken (in minutes).

Remote Picture Capture Settings

In this mode the iRIS-CAM will take a picture on request from HydroTel™. There are no iRIS based settings required for this mode. Picture capture will happen automatically and can be used in conjunction with schedule mode.

Resolution of the remotely requested picture can be different to ones taken by the scheduler, alarm or user.

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15 Appendix E – Upgrading Firmware/Software

15.1 Overview

This section describes the procedure to use when upgrading the firmware/software components in an iRIS.

The upgrade procedure has been carried out many times without issue. However, because the process does involve erasing and reprogramming of flash memory, it is important that a good, securely connected power supply is provided to the iRIS throughout the upgrade process.

15.2 File Naming Conventions

15.2.1 iRIS Executive Firmware.

The "Firmware" in the iRIS is analogous to the operating system in a PC. It is the Firmware that contains all the low level functions and library routines used by the Application Software.

The iRIS firmware is available as a single file for downloading and flash upgrading using iLink. The upgrade file is in the format:

iRIS350X_xxx.fls where:

xxx is the firmware version

e.g. iRIS350X_130.fls iRIS 350X Firmware, Version Vx/1.30

The default repository for the firmware files is the "Firmware" folder under iLink.

15.2.2 iRIS Application Software.

The "Application Software" in the iRIS is analogous to an application such as Word® on a PC. It is the software that contains the general functionality of the iRIS. This comes in three sections or "banks" (due to the memory configuration of the iRIS) but runs as if it were one single program.

The common software upgrade files for Banks 1 and 3 are always in the format:

iRIS350X_xxxx_yyy_z.irx where:

xxxx is the communication type (Cellular, NoModem etc).
yyy is the software version
z is the program bank that this file should be loaded into

e.g. iRIS350X_Cell(W)_130_1.irx iRIS 350X Software, Cellular(Wavecom), Version 1.30, Bank 1

The file for Bank 2 can be different depending on the program variant. This means that the Bank 2 file has an extra field in its name. The default variant name is "Std" for the standard issue software.

e.g. iRIS350X_Cell(W)_Std_130_2.irx iRIS 350 Software, 3G, Standard, Version 1.30, Bank 2

The default repository for the program files is the "Programs" folder under iLink.

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15.3 iRIS Automated Upgrade Procedure

iLink (from version 3.20.0+) has an automated firmware/software upgrade tool that supports the iRIS 350X. This tool includes several checks to confirm the validity of the components being installed.

The automated upgrade tool can do both the firmware and software upgrades in one process, saving considerable time and effort. However, it is more common to just upgrade the software, so the default mode is set for software only. Including the firmware in the upgrade requires the manual enabling of a checkbox.

Upgrading the firmware results in the program bank 1 being erased. A firmware upgrade must always be followed by a software upgrade (or a reinstallation of the current version).

For clarity, the example given below shows a full, automatic firmware and software upgrade for an iRIS 350X. To convert an iRIS 350 to an iRIS 350X, the procedure is similar. Please see Section 15.5 for details on how to perform the conversion.

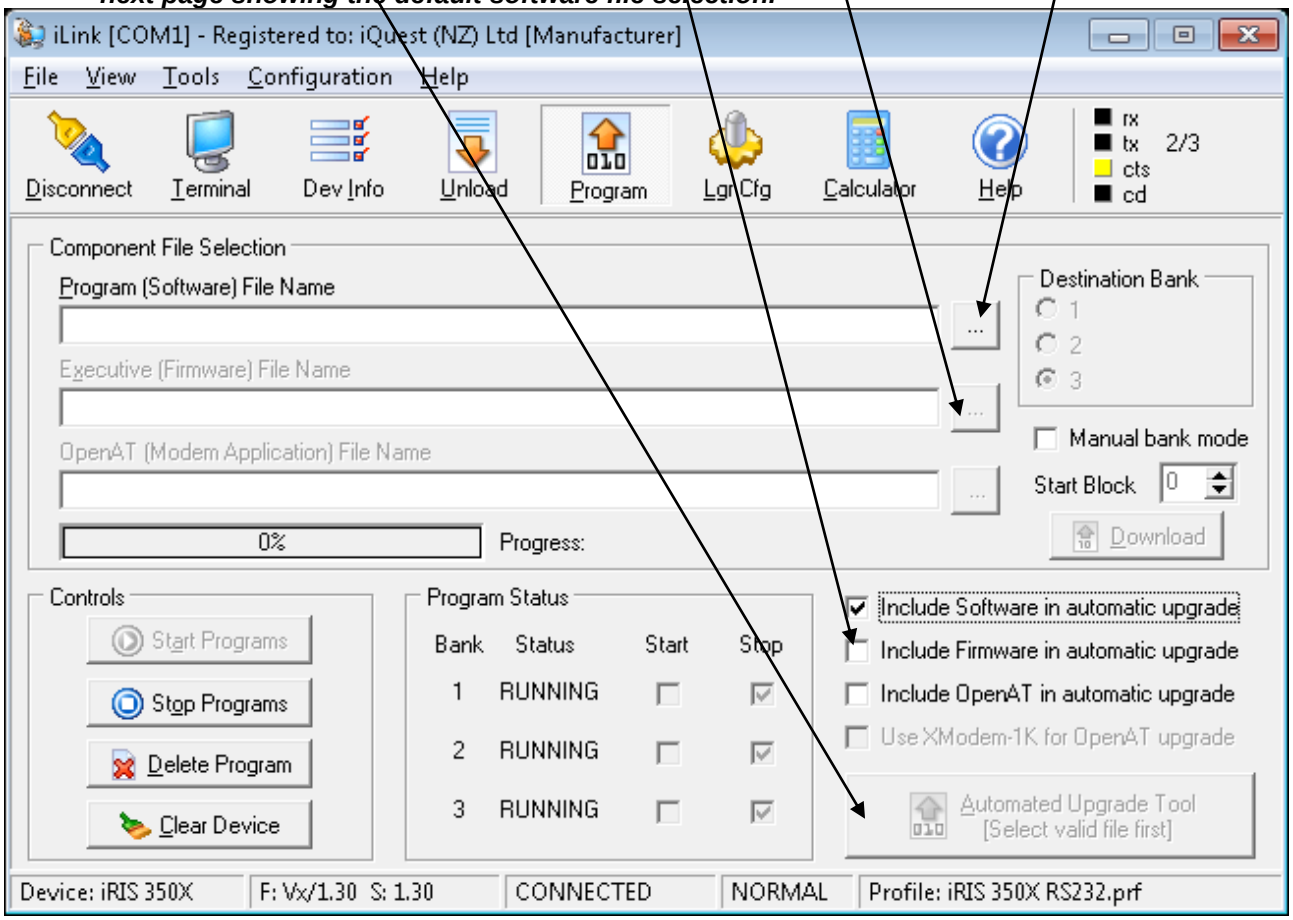
19. Make sure the required upgrade files are available on the computer. Ideally these should be located in the default deployment folders listed above in Section 15.2.

20. Connect to the iRIS using iLink.

21. Go to the Program Device screen via the **[Tools][Program Device]** menu option or by clicking the [Program] button on the toolbar.

22. If upgrading the firmware, first enable the [Include Firmware in automatic upgrade] checkbox and then select the new firmware file using the firmware [Browse] button. ***See note on the next page showing the default firmware file selection.***

23. Select any one of the three upgrade software program files using the [Browse] button. The [Automated Upgrade Tool] button will become enabled if the software file exists. ***See note on the next page showing the default software file selection.***



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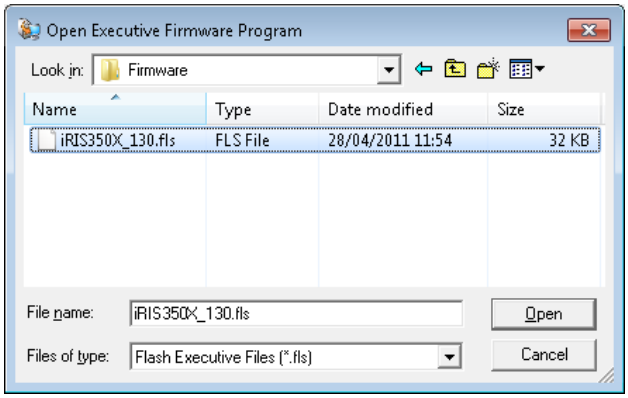
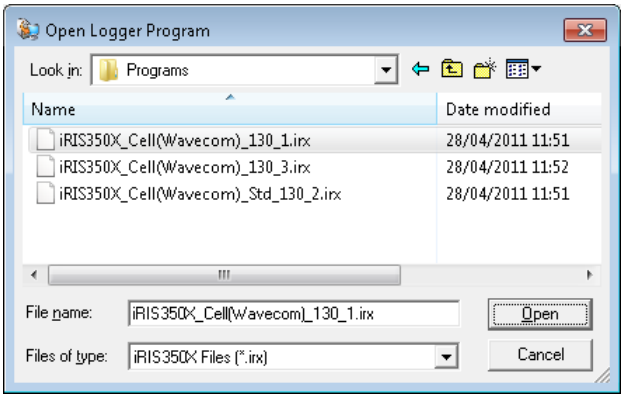


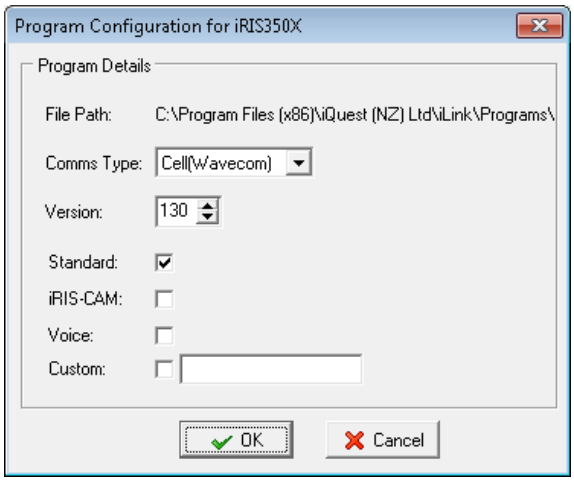


*The flash executive files are stored in the default firmware folder …\iLink\Firmware and are identified by the filename extension **.fls**. Select the correct firmware file to download to the iRIS.*

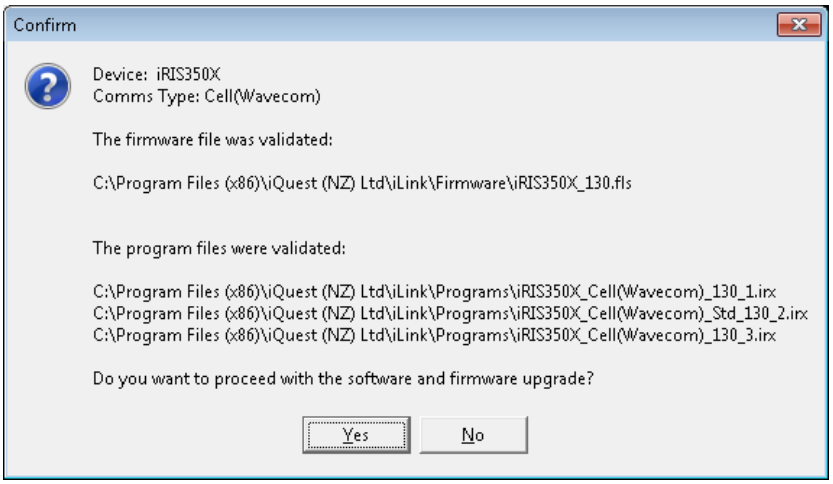
*The application software files are stored in the default firmware folder …\iLink\Programs and are identified by the filename extension **.irx**. Select any one of the files.*

24. Click the [Automated Upgrade Tool] button. The Program Configuration form will appear. This form allows you to reconfirm the program validity (variant and version) as well as select specialised program variants such as camera, voice or custom. The example form below shows the standard program V1.30 for a cellular (Wavecom) iRIS350X.

For the camera or voice variants, simply enable the appropriate checkbox. For custom program variants, enter the custom program name as supplied by iQuest and enable the "Custom" checkbox.



25. Click the [OK] button to continue. The upgrade components are validated and if successful a confirmation dialog is shown. Click [Yes] to continue. Otherwise correct the problem and try again.



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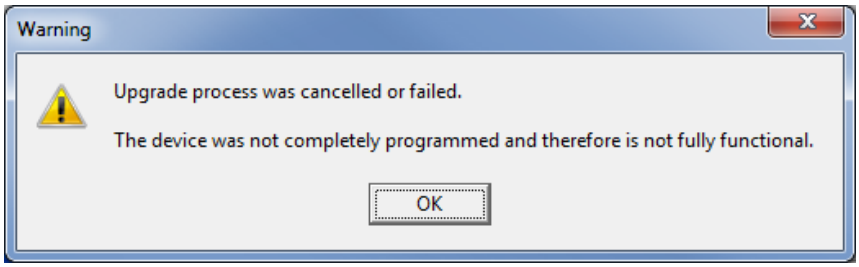
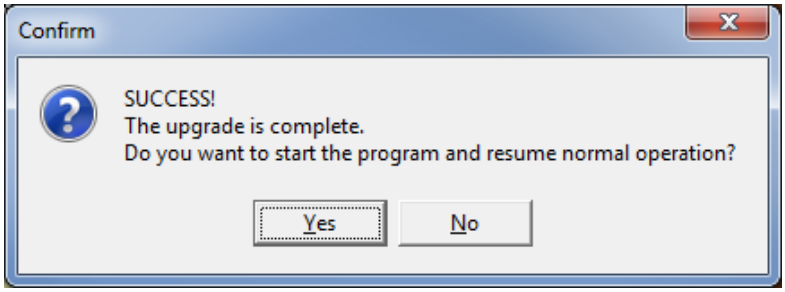
26. Before the upgrade is initiated, you will be prompted about whether the device should be cleared before upgrading. By default, this is “No” as it will result in clearing the logger configuration and if applicable, any logged data. However, if the difference between the old program and the new one is significant, doing this step is recommended. iQuest will provide advice on whether this should be done in the program release notes.

27. After the device is cleared, or if the clearing step is skipped, the upgrade process will begin and run automatically through the firmware (if selected) and software upload stages. The progress status is displayed as the upgrade progresses.

If the process is cancelled or fails for any reason, the following dialog will appear. The whole process should be repeated to ensure that the iRIS is completely upgraded before deployment.



28. When the upgrade is complete this dialog will be displayed. Click [Yes] to start the iRIS software program.



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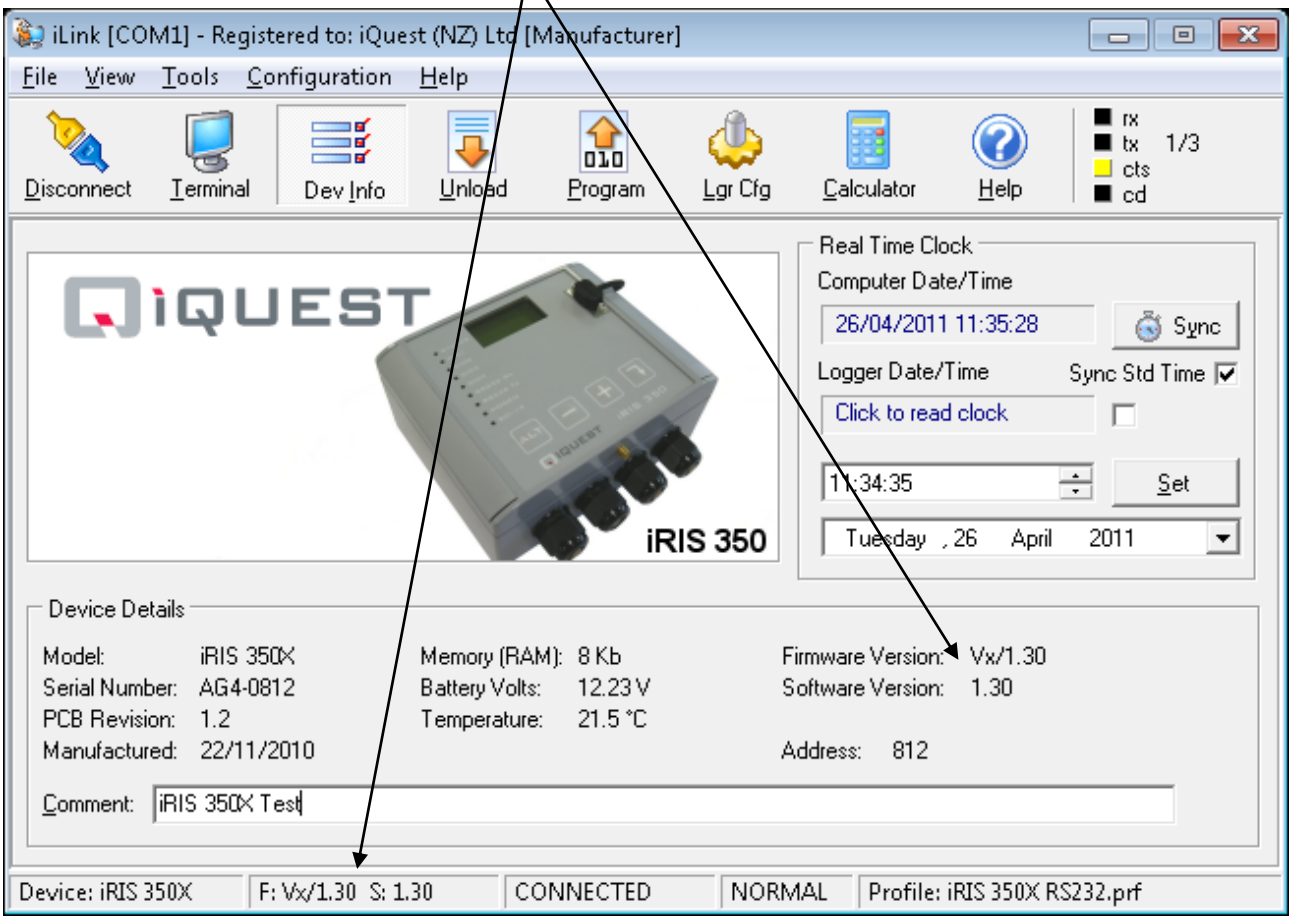
29. Finally, iLink will automatically disconnect and reconnect which will refresh the device information. You should note that the firmware and software versions on the status bar and device information panel changes, confirming that the process has completed successfully.



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15.4 Wavecom Modem Core Firmware Upgrade Procedure

ONLY APPLICABLE TO WAVECOM MODEM VERSIONS

NOTE: This procedure assumes familiarity with HyperTerminal®, which is the default serial terminal program that is supplied with Windows® operating systems up to XP.

1) Connect to the iRIS with HyperTerminal®. Settings should be 38,400bps, no parity, eight data bits and one stop bit. (38400 n 8 1).

2) The Main menu should appear as shown below:

```
* iRIS 350X Cellular(W) (AG1-0000 Fx.xx Sx.xx Ox.xx)
1 Site Name [My Site Name]
2 Power [Partial Save, DC]
3 Comms
4 Sensors
5 Outputs
6 Date/Time [12 Apr 2011, 08:12:48, UTC +12hrs]
7 PIN Code [0001]
8 Miscellaneous
>
```

3) Select the Miscellaneous menu (option 8). The miscellaneous menu will appear:

```
* Misc Cfg
0 Exit
1 Initialize
>
```

4) Select Initialize (option 1). This prompt will appear:

```
> Type 'init' to initialize the unit.
=
```

5) Enter the hidden request command “wismo” to switch the unit into native communication mode with the wireless module. The following message will appear.

```
=wismo

Invoking Wismo direct access mode
Change terminal to 115200bps...
```

6) Disconnect HyperTerminal. Change the port speed to 115,200bps and disable the “Echo type characters” option. Reconnect again.

7) Type “AT”[Enter] to confirm the link is operating to the module. An OK response should be received.

8) Type AT^IVER?[Enter] to display the core firmware version. Check the version to determine if the iRIS actually requires an update.

```
at^iver?
iQuest Embedded OpenAT Core. Version: 1.00
Target hardware platform: Q26EXTREME
```


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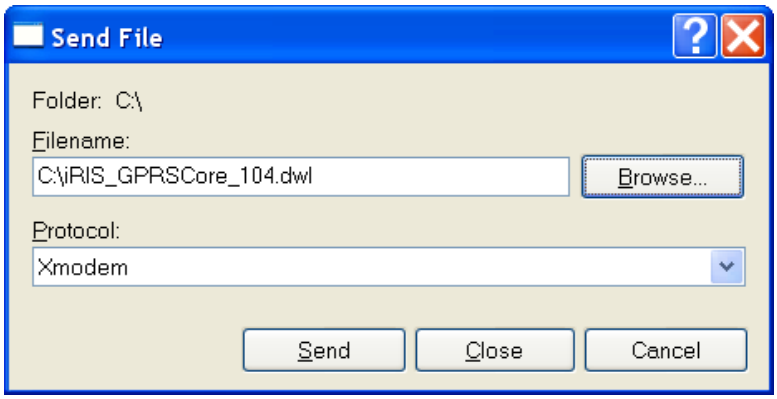
9) If an upgrade is not required, go to step 16 and restart the unit. If the upgrade is to be undertaken, put the GSM module into programming mode by entering the command AT+WDWL[Enter]. It will start transmitting a special prompt character at regular intervals.

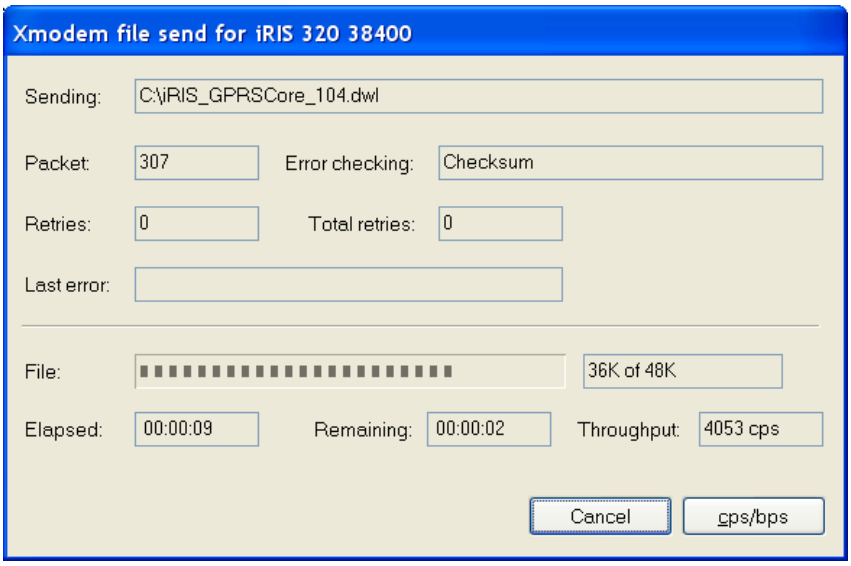
```
at+wdwl
+WDWL: 0
SSSSS
```

10) On the HyperTerminal® menu, select Transfer-> Send File.

11) Set the protocol to X-Modem and select the iCE^3 firmware file that has been supplied by iQuest. This file is in the format iRIS_GPRSCore_xxx.dwl.



12) Click 'Send' and the file should download to the device. DO NOT DISCONNECT OR CANCEL THIS STEP AS IT MAY DAMAGE THE WAVECOM MODULE!



13) When download is complete, the Wavecom module will resume outputting the prompt character.

14) Now, type the command AT+CFUN=1[Enter] to reinitialize the module.

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15) When it has rebooted, recheck the version using the AT^IVER? command again.

```
§§§§§at+cfun=1
OK
+WIND: 3

at^iver?

iQuest Embedded OpenAT Core. Version: 1.04
Target hardware platform: Q26EXTREME
OK
```

16) The Wavecom module core firmware upgrade is now complete. The version is showing V1.04 correctly. Restart the iRIS by pressing the Alt key or by depowering and repowering it.

15.5 Converting an iRIS 350 to an iRIS 350X

All ongoing firmware/software support and development for the iRIS 350 will be for the iRIS 350X. Therefore this procedure will be commonly done as units are upgraded to take advantage of what the hardware is capable of, but the previous (iRIS 320 compatible) software did not utilise.

Please be familiar with the differences between the two "devices" by referring to Section 2.4 on page 6. iQuest staff are more than happy to assist with this conversion process

Although the hardware is identical, the conversion is a major procedure which completely reorganises the internal configuration and memory structure of the iRIS 350. If the conversion is being done to an already installed iRIS 350 then the following points should be noted:

- ***All existing iRIS 350 configuration and logged data will be destroyed. A complete unload of all logged data should be done and any existing sensor, I/O and communication configuration noted before the conversion is started.***
- ***Sensor source ids may be different as several new ones are available in the iRIS 350X.***
- ***Logged data array ids may change, in particular associated logs such as minimum, maximum and standard deviation. This will impact the configuration of HydroTel and the point identifiers should be altered to suit.***

Before commencing the configuration, make sure the following files are available:

- iLink V3.20.0 or later installed and registered to Adminstrator level.
- iRIS 350X Firmware V1.30 or later (one .fls file required)
- iRIS 350X Software V1.30 or later (three .irx files required). If a camera, voice or other software variant is required, please make sure you have the correct bank 2 file.
- Wavecom Open AT application file V1.04 or greater for the embedded modem (one .dwl file required).

1. Connect to the iRIS 350 using iLink via an RS232 connection as usual. DO NOT ATTEMPT TO CONVERT THE DEVICE USING ANY OTHER COMMUNICATION METHOD THAN RS232.
2. If required, unload the logged data and note configuration settings that will be needed to set up the newly converted iRIS 350X.
3. When ready to begin the conversion, first upgrade the Wavecom modem's Open AT application following the directions in Section 15.4 above.
4. Next, select the iRIS 350X firmware file and do a firmware only upgrade and select Yes when prompted to clear the device.
5. When the unit has restarted, disconnect iLink and reconnect to the device. It should now indicate that it is an iRIS 350X.
6. Now install the iRIS 350X software, again selecting "Yes" when prompted to clear the device.
7. Once this step is complete the device should now be a fully operational iRIS 350X ready for configuration.

16 Appendix F – SDI-12

16.1 What is SDI-12?

SDI-12 stands for **S**erial **D**igital **I**nterface at **12**00 bps. It is a standard to interface battery powered data recorders with microprocessor-based sensors designed for environmental data acquisition (EDA).

EDA is accomplished by means of a sensor, or sensors, and a data recorder, which collects and saves the data. SDI-12 is a standard communications protocol, which provides a means to transfer measurements taken by an intelligent sensor to a data recorder. An intelligent sensor typically takes a measurement, makes computations based on the raw sensor reading, and outputs the measured data in engineering units. For example, an SDI-12 pressure sensor may take a series of pressure measurements, average them, and then output pressure in psi, inches of mercury, bars, millibars, or torrs. The sensor's microprocessor makes the computations, converts sensor readings into the appropriate units, and uses the SDI-12 protocol to transfer data to the recorder.

SDI-12 is a multi-drop interface that can communicate with multi-parameter sensors. Multi-drop means that more than one SDI-12 sensor can be connected to a data recorder. The SDI-12 bus is capable of having ten sensors connected to it. Having more than ten sensors, however, is possible. Some SDI-12 users connect more than ten sensors to a single data recorder.
Multi-parameter means that a single sensor may return more than one measurement. For example, some water quality sensors return temperature, conductivity, dissolved oxygen, pH, turbidity, and depth.

16.2 Advantages of SDI-12

A serial-digital interface is a logical choice for interfacing microprocessor-based sensors with a data recorder. This has advantages for sensors and data recorders.

- Unique and complex self-calibration algorithms can be done in microprocessor-based sensors.
- Sensors can be interchanged without reprogramming the data recorder with calibration or other information.
- Power is supplied to sensors through the interface.
- Hybrid circuit and surface mount technologies make it practical to include the power supply regulator, a microprocessor, and other needed circuitry in small sensor packages.
- Sensors can use low cost EEPROMs (electrically erasable programmable read only memory) for calibration coefficients and other information instead of internal trimming operations.
- The use of a standard serial interface eliminates significant complexity in the design of data recorders.
- Data recorders can be designed and produced independently of future sensor development.
- SDI-12 data recorders interface with a variety of sensors.
- SDI-12 sensors interface with a variety of data recorders.
- Personnel trained in SDI-12 will have skills to work with a variety of SDI-12 data recorders and SDI-12 sensors.

16.3 SDI-12 Electrical Interface

The SDI-12 electrical interface uses the SDI-12 bus to transmit serial data between SDI-12 data recorders and sensors. The SDI-12 bus is the cable that connects multiple SDI-12 devices. This is a cable with three conductors:

1) A serial data line
2) A ground line
3) A 12-volt line

In the following specifications, all values not indicating specific limits have an allowable tolerance of ±10% of the value. The SDI-12 bus is capable of having at least 10 sensors connected to it.

Serial Data Line

The data line is a bi-directional, three-state, data transfer line. Table 1 shows the logic and voltage levels for the transmission of serial data for the SDI-12 standard. The data line uses negative logic.

Condition	Binary state	Voltage range
Marking	1	-0.5 to 1.0 volts
Spacing	0	3.5 to 5.5 volts
Transition	undefined	1.0 to 3.5 volts

Table 1. Logic and voltage levels for serial data

Voltage Transitions

During normal operation, the data line voltage slew rate must not be greater than 1.5 volts per microsecond.

Ground Line

The ground line must be connected to the circuit ground and the earth ground at the data recorder. The sensor circuit ground also must be connected to the ground line, but not normally to its own earth ground. If it is necessary to connect the sensor circuitry to earth ground, a heavy (12 AWG or larger) ground wire should be connected between the sensor earth ground and the data recorder earth ground for lightning protection.

The ground conductor should be large enough to keep the voltage drop between the data recorder and all sensors less than 0.5 volts during the maximum combined sensor current drain.

12 Volt-Line

The data recorder (or the external power supply) provides between 9.6 volts and 16 volts to the 12-volt line, with respect to ground, as measured under a maximum sensor load of 0.5 amperes. SDI-12 does not require the data recorder to be the source of power to the 12-volt line. Sensors connected to the 12-volt line must not have inductive loads. SDI-12 does not require voltage limiting for transient protection in the sensor. Transient protection is however recommended.

This information is taken from:

SDI-12 Serial-Digital Interface Standard for Microprocessor-Based Sensors, Version 1.3 – January 12, 2009

Prepared By
SDI-12 Support Group
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17 User Notes

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