

The HydroMet logo features a stylized white slash mark followed by the word "HydroMet" in a bold, white, sans-serif font. The background of the top half of the cover is a photograph of a bright sun partially obscured by large, white, fluffy clouds against a deep blue sky. Two diagonal, semi-transparent blue bands cross the image from the top corners towards the center.

/HydroMet

User Manual

iRIS 150FX

The KISTERS logo consists of a stylized white 'K' symbol followed by the word "KISTERS" in a bold, white, sans-serif font. Below the company name is the tagline "Empowering decisions of tomorrow" in a smaller, white, sans-serif font.

KISTERS
Empowering decisions of tomorrow

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I Disclaimer

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred.

This manual does not include all of the details of design, production, or variation of the equipment nor does it cover every possible situation which may arise during installation, operation or maintenance. KISTERS shall not be liable for any incidental, indirect, special or consequential damages whatsoever arising out of or related to this documentation and the information contained in it, even if KISTERS has been advised of the possibility of such damages.

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This document is public.

II Safety Instructions

- Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS iRIS 150FX. The manual provides information on how to operate the product. The manual is intended to be used by qualified personnel, i.e. personnel that have been adequately trained, are sufficiently familiar with installation, mounting, wiring, powering up and operation of the product.
- Keep the user manual on hand for later reference!
- If you encounter problems understanding the information in the manual (or part thereof), please consult the manufacturer or its appointed reseller for further support.
- KISTERS iRIS 150FX is intended to be used in hydrometeorological or environmental monitoring applications.
- Before starting to work, you have to check the functioning and integrity of the system.
 - Check for visible defects on the iRIS 150FX, this may or may not include any or all of the following mounting facilities, connectors and connections, mechanical parts, internal or external communication devices, power supplies or power supply lines, etc.
 - If defects are found that jeopardize the operational safety, work must be stopped. This is true for defects found before starting to work as well as for defects found while working.
- Do not use the KISTERS iRIS 150FX in areas where there is a danger of explosion.
- The present user manual specifies environmental/climatic operating conditions as well as mechanical and electrical conditions. Installation, wiring, powering up and operating the KISTERS iRIS 150FX must strictly comply with these specifications.
- Perform maintenance only when tools or machinery are not in operation.
- If guards are removed to perform maintenance, replace them immediately after servicing.
- Never make any electrical or mechanical diagnostics, inspections or repairs under any circumstances. Return the product to the manufacturer's named repair centre. You can find information on how to return items for repair in the relevant section of the KISTERS website.



- Disposal instructions: After taking the KISTERS iRIS 150FX out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS iRIS 150FX is never to be disposed in household waste!
-  Inputs and outputs of the device are protected against electric discharges and surges (so-called ESD). Do not touch any part of the electronic components! If you need to touch any part, please discharge yourself, i.e. by touching grounded metal parts.

1 Introduction

Thank you for choosing our product. We hope you will enjoy using the device.

KISTERS manufactures, sells, installs and operates quality instrumentation, data loggers and communication technology. Products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy and robustness needed to fulfil the requirements of measurement practitioners in the field.

The present User Manual will help you understand, install and deploy the device. If, however, you feel that a particular information is missing, incomplete or confusing, please do not hesitate to contact us for further support!

The iRIS 150FX is a small, compact datalogger featuring an LCD display and keypad. It can be connected to a wide variety of sensors, and features two analogue (0 - 5 V, 0 - 20 mA) inputs, two digital inputs, SDI-12 serial instrument support and a single digital output for alarm or control purposes.

The iRIS 150FX is supplied in a powder-coated die-cast aluminium enclosure. Power supply and I/O connections are provided by a small screw terminal block within the unit. Cable access is via two NG12 glands on the bottom edge of the enclosure. A small text/graphics LCD provides the user display and user input is via a four key keypad in the same style as other iRIS dataloggers.

The iRIS 150FX supports a maximum of six virtual sensors, the sources of which can be chosen from a range of physical digital or analogue types. Each sensor can be checked for up to six separate alarm conditions, each with separate trigger and reset levels. Each alarm also has an optional 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, flow meter pulse etc.). Data is logged in a four word (8 byte) compressed format which includes full date and time to fractions of a second.

The alarm(s) can be linked to the digital output to activate external equipment when one or more alarms are activated in the event of alarm activation.

Feature Summary

The iRIS 150FX has the following features:

- IP65 rating
- LCD and keypad
- RS-232 interface
- 6 simultaneous logging channels (virtual sensors)
- 3 auxiliary logging channels for internal measurements
- 2 digital inputs (pulse, frequency, counter)
- 2 analogue inputs (0 - 5 V fixed span – current e.g: 0 - 20 mA with internal resistor enabled)
- 1 digital output (open drain pull-down). A switched supply voltage output is available on iRIS 150FXC.
- 6 alarms. Can be associated with any of the main six logging channels. Can activate the digital output if any alarm is activated.
- Internal, replaceable 3.6 V AA size lithium battery backup. Or D size battery option is available.

Typical Applications

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

- Rainfall measurement
- Water / power / gas metering
- River level monitoring
- Wind measurement
- Mobile temperature monitoring
- Irrigation monitoring / control

1.1 About this Manual

This manual is intended as a detailed guide for iRIS 150FX installation, configuration and operation.

This manual is also available online in Adobe Acrobat® pdf format for registered users at www.hyquestolutions.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.

Note: The term “iRIS” is used throughout this manual in all references to the iRIS 150FX.

1.2 Key Features

This chapter contains the following subsections:


- [Data Logging](#) 
- [Logged Data Array Identification](#) 
- [Alarm Processing](#) 
- [Real Time Clock & Calendar](#) 
- [Security](#) 

1.2.1 Data Logging

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

- Analogue Input 1
- Analogue Input 2
- Pulse Counter attached to Digital Input 1
- Pulse Counter attached to Digital Input 2
- Simulated Pulse Counter enabled by Digital Input 1
- Simulated Pulse Counter enabled by Digital Input 2
- Frequency Counter attached to Digital Input 1
- Frequency Counter attached to Digital Input 2
- Up/Down Counter attached to Digital Inputs 1 & 2
- Database location (data obtained from special script)
- Floating Point Database location
- External DC power supply input – on change of state basis only
- SDI-12
- External supply value
- Temperature
- Change of State attached to Digital Input 1
- Change of State attached to Digital Input 2
- Day To Now Total attached to Digital Input 1
- Day To Now Total attached to Digital Input 2
- Year To Date Total attached to Digital Input 1
- Year To Date Total attached to Digital Input 2

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 up to once per minute or immediately in event mode for pulse inputs.

It is also possible to configure a sensor to also log minimum, maximum or a calculated flow rate (pulse source only) values. Refer to the following descriptions in Section [Sensors](#)  for further detail on configuring these extended logging features as part of the Sensor Cfg menus.

1.2.2 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 or total), the array ID has an offset added to the sensor number that it is derived from. These ID offsets are as follows:

Minimum:	+20
Maximum:	+40
Standard Deviation:	+60 (Not currently supported)
Flow Rate or Total:	+80

For example, Sensor 4 has been configured to log the average value, plus the maximum. Two data arrays will be logged for this sensor at each log interval with IDs of 4 and 44 respectively. In HydroTel™ these will then relate to point identifiers of 4 and 44.

1.2.3 Alarm Processing

Each virtual sensor can be checked for two separate alarm conditions. Each alarm has separate trigger and reset levels, as well as an activation delay or accumulation period depending upon the data type. The alarms can also be used to control the digital output or to generate a call-back to a base station when the logger is operating in telemetered mode. See Sections [Digital Output](#) ⁽¹⁵⁾ for further details on digital outputs or Section [Telemetered Mode](#) ⁽⁵²⁾ for details on using Telemetry mode.

1.2.4 Real Time Clock & Calendar

The iRIS 150FX has a non-volatile real time clock that can be set by the user via iLink 2012 or HydroTel™.



If the clock is invalid (year < 2011), logging is inhibited. To draw attention to this situation, the LCD will flash once per second until the clock is set correctly.

1.2.5 Security

The iRIS 150FX can be configured with a PIN code to prevent unauthorised access to restricted information through the LCD and keypad. When a user is logged on, the totalisers can be reset via the keypad or a terminal session. When the unit is locked, the totalisers can only be reset via a terminal session.

The PIN code is configured via the General Configuration section in iLink 2012. See Section [General](#) ⁽²⁶⁾ for more details.

1.3 iRIS 150 and iRIS 150FX Comparison

- Standard IEEE-754-2008 compliant Floating Point library.
- Datalogging sample values are floating-point with support for invalid values (NaN) if over-range analogue inputs or failed SDI-12 communication. Logging multiplier completely removed!
- All timestamping is in UTC for internationally diverse markets.
- Default RS232 port speed increased from 38,400 to 115,200 bps.
- Configuration via text terminal removed and only basic terminal diagnostics supported.
- SDI-12 firmware engine re-engineered and now V1.3 compliant.
- Supports an optional custom SDI-12 command with a separate schedule from measurements.
- Alarm processing completely rebuilt. No longer 2 fixed alarms per sensor. Now a pool of 6 general alarms. Each can be assigned to a sensor as required.
- Sensor logging rate can be different when alarm(s) on that sensors are active.
- All schedules have separate on/off/alarm intervals.
- Totalisers: YTD (Year To Date) and Last Year. Settable roll-over time (daily) or date (yearly).

- Sensor display format is settable (number of decimal places).
- Multi-language support for internal date/times etc. Five supported (EN, DE, FR, ES, PO).
- Secure and reliable OTA (Over The Air) firmware and software upgrades now possible. (Requires compatible communications device)

1.4 Support

Technical support for the iRIS 150FX is available by contacting:

HyQuest Solutions (NZ) Ltd

P.O Box 9466

Hamilton

NEW ZEALAND






Tel: +64 7 857-0810

Email: support@hyquestsolutions.co.nz

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

2 Installation

This chapter contains the following subsections:

- [Recommended Deployment Procedure](#) 
- [Mounting](#) 
- [External I/O Connector \(iRIS 150FXC\)](#) 
- [Internal I/O Connector \(iRIS 150FXG\)](#) 
- [Sensor Connection Examples](#) 

2.1 Recommended Deployment Procedure




This chapter contains the following subsections:

- [Prior to site visit](#) 
- [Installation on site](#) 

2.1.1 Prior to site visit

If possible, configure the iRIS 150FX completely before taking it into the field for installation. Use the typical configuration examples below as a guide. After configuration, when the battery is removed again prior to installation, all configuration settings will be retained with the exception of the date and time and data logging pointers. These are set as part of final commissioning.

2.1.2 Installation on site

- Remove the enclosure lid by removing the four screws from the corners.
- Mount the enclosure base in the desired location using suitable screws through the two mounting holes in the base side walls.
- Remove the rubber sealing plug from one or both glands. Feed the connection cable(s) through the glands, but do not tighten the glands yet.
- Terminate any instrumentation first (water meter reed switches, level sensors etc) before connecting the datalogger. **Do not live on any power supplies yet.**
- Strip the cable ends and trim the wire ends for connection into the terminals. If the cable is shielded, ensure that loose shield wire ends are covered with heat shrink tube to prevent short circuits.
- Terminate the wire ends into the appropriate connectors. Note that the terminals are small and care should be taken to avoid excessive bare wire lengths or loose strands being exposed.
- Check the settings of the analogue input and digital input jumpers and set them appropriately. Refer to Sections [Analogue Inputs](#)  and [Digital Inputs](#)  for details on these.
- Adjust the amount of cable inside the enclosure to enable the lid to be fitted easily without jamming. Tighten the glands.
- Install the lithium battery, ensuring it is installed the correct way round. The logger should start.
- Secure the lid with the four screws. Apply external power if used (battery or d.c supply)
- With a laptop, set the time and date and also test that all sensor values are correctly scaled and working.
- Initialise the logger which will reset pointers and totalisers. See Option 3 in Section [Terminal Menus](#) .
- Allow the logger to log at least a few samples. Unload the data and check it is correct.

2.2 Mounting

The iRIS 150FX can be mounted to almost any surface by using suitable screws through the two internal mounting pillars. These are exposed by removing the lid.

2.3 External I/O Connector (iRIS 150FXC)

All I/O and power supply terminations are via a small 14-way pluggable screw terminal block mounted on the bottom edge of the enclosure. This connector block is wired internally to the PCB in the factory. The functions of the connector terminals are shown in the table below.

Abbreviation	Description
GND	Ground (Digital)
SWV	Switched +Vin External Power Supply. Controlled by Digital Output
AI2	Analogue Input #2
GND	Ground (Analogue)
AI1	Analogue Input #1
GND	Ground (Analogue)
DI2	Digital Input #2
GND	Ground (Digital)
DI1	Digital Input #1
GND	Ground (Digital)
DO1	Digital Output (open drain pull-down)
SDI	SDI-12 data connection
+Vin	5 - 15 V DC External Power Supply
GND	0 V DC External Power Supply / Ground

Table 1 - Internal I/O Terminal Designations

2.4 Internal I/O Connector (iRIS 150FXG)

All I/O and power supply terminations are via a small 12-way screw terminal block on the internal PCB. Cables enter the enclosure via small compression glands to maintain water resistance. The functions of the internal connector terminals are shown in the table below.

Abbreviation	Description
AI2	Analogue Input #2
GND	Ground (Analogue)
AI1	Analogue Input #1
GND	Ground (Analogue)
DI2	Digital Input #2
GND	Ground (Digital)
DI1	Digital Input #1
GND	Ground (Digital)
DO1	Digital Output (open drain pull-down)
SDI	SDI-12 data connection
+Vin	5 - 15 V DC External Power Supply
GND	0 V DC External Power Supply / Ground

Table 2 - External I/O Terminal Designations

This chapter contains the following subsections:

- [Internal Lithium Battery](#) ¹³
- [External Power Supply](#) ¹⁴
- [Analogue Inputs](#) ¹⁴
- [Digital Inputs](#) ¹⁴
- [Digital Output](#) ¹⁵

2.4.1 Internal Lithium Battery

The iRIS 150FX has an internal AA size 3.6 V, 2400 mA/Hr lithium battery, which provides the power supply when no external dc power supply is available. When external power is connected, the internal battery is completely disconnected. The battery may be replaced by the user.



The internal AA battery is not intended for long-term use, rather as a back-up in the event of loss of external power. Standard AA cells such as Alkaline, NiCad, NiMH, etc, cannot be used in the iRIS as they do not supply sufficient voltage.



A variant is available that has a D-size lithium battery installed and this can be used for self-powered installations connected to a rain gauge or water meter.

2.4.2 External Power Supply

The iRIS 150FX is designed to operate with an external supply so that the internal backup battery is disconnected. Any external DC power source ranging from 6 - 15 V DC can be used. A solar panel may also be connected but will require a regulator and external battery to limit the supply voltage to the iRIS. A typical solar panel without regulation can generate up to 21 V, which exceeds the iRIS 150FX external DC input range.

The external power supply is protected against reverse connection or over-voltage by ultra-fast acting protection devices and a self-resetting semiconductor fuse.

2.4.3 Analogue Inputs

Analogue inputs are uni-polar 0 - 5 V DC with 12 bit resolution. They present a load impedance of approximately 100 k Ω .

Suitable scaling factors should be chosen to convert from a raw value of 0 - 5000, which reflects the input signal range of 0 - 5 V (0 - 5000 mV). When current sources are used, an internal sink resistor (250 Ω) is connected between the analogue input and AGND. The diagram below shows the position of the two analogue links. Fit the link to set the analogue input to current mode, or remove the link to set it to voltage input mode (default).

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

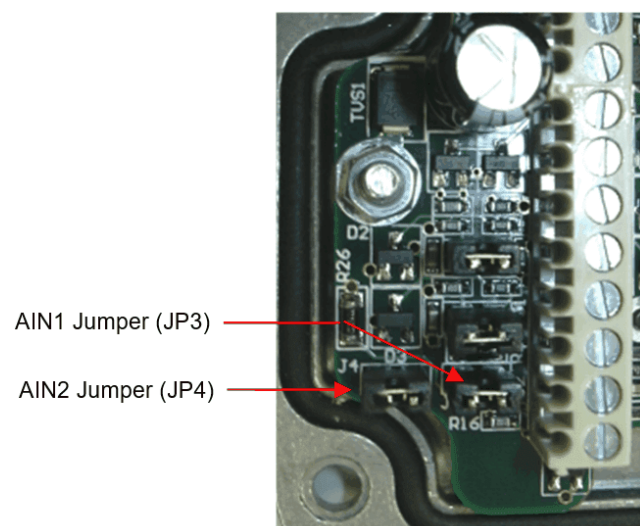


Figure 1 - Analogue Selection Jumpers

2.4.4 Digital Inputs

The two digital inputs are jumper selectable for either mechanical or electronic operation. In either case it is necessary to pull the input down to 0 V DC to activate it. Inputs will handle up to 30 V DC in the off state for parallel connection across existing equipment. Jumpers are positioned to the left hand side of the I/O connector. The top jumper is for Digital Input #1 and the middle jumper is for Digital Input #2.

Fit the jumper for mechanical switching at up to 20 Hz. In this mode a 100 nF capacitor is fitted across the input to provide limited hardware debounce, preventing false triggering due to contact bounce. Remove the appropriate jumper for electronic switching at up to 5 kHz.

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

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, KISTERS 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).

DI1 Debounce
Jumper (JP1)

DI2 Debounce
Jumper (JP2)

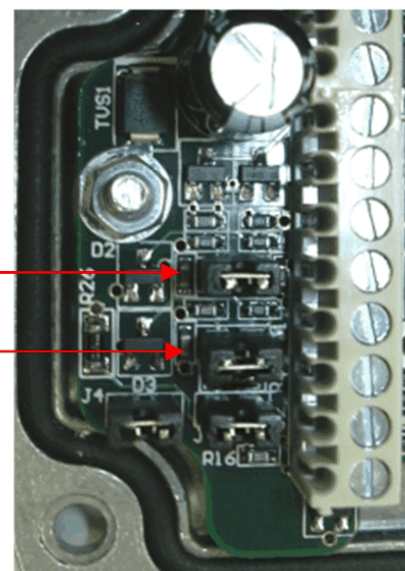


Figure 2 - Digital Input Debounce Jumpers

2.4.5 Digital Output

The Digital Output is open drain pull-down and is capable of sinking up to 300 mA at 30 V DC. Typically this could be used to drive a relay powered by an auxiliary DC supply (e.g. 12 V). In this mode, the negative of the relay supply must be connected to one of the iRIS GND terminals.

The output can be programmed to follow a schedule for use in powering external sensors / circuits, or operate in response to alarm activation from any of the sensors.



On the iRIS 150FXC variant, the digital output also controls the switched +Vin supply voltage. When the digital output is activated, the supply voltage on +Vin is switched to the SWV terminal and can be used to power external loads without the need for a separate transistor switch.

See Section [Digital Output](#) ^[29] for details on the digital output modes.

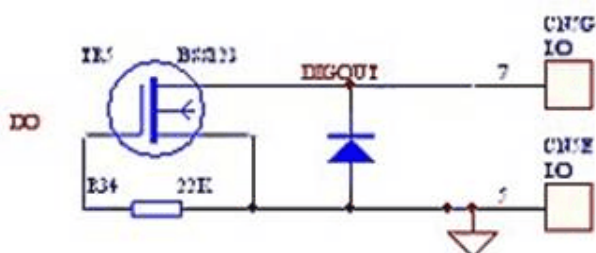


Figure 3 - Digital Output Circuit

2.5 Sensor Connection Examples

This chapter contains the following subsections:

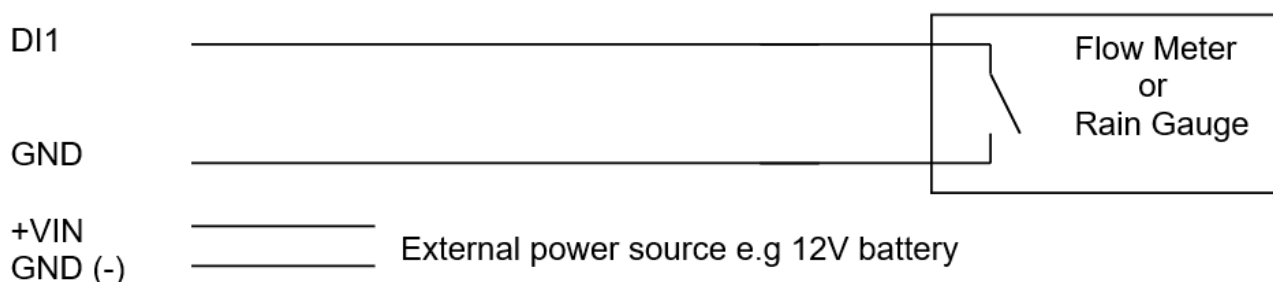
- [Connecting a Flow Meter or Rain Gauge](#) ^[16]
- [Simulating a Flow Meter using Auto-Pulse mode](#) ^[18]
- [Connecting a 0 - 5 V Pressure Transducer](#) ^[19]
- [Connecting a 2-Wire Loop-Powered 4-20mA Sensor](#) ^[20]
- [Measuring the External Supply Voltage](#) ^[20]
- [Connecting SDI-12 Instruments](#) ^[22]
- [Connecting an Up/Down Water Level Instrument](#) ^[23]
- [Connecting Analogue Wind Instruments](#) ^[23]

2.5.1 Connecting a Flow Meter or Rain Gauge

One of the most common uses 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 (DI1 or DI2) and a ground (GND) 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 GND. See Section [Digital Inputs](#) ¹⁴ for details on the digital inputs and using the debounce link.

Both inputs can be used simultaneously and each input has three associated totalisers, which are viewable from the LCD. See Section [Totals Screens \(DI1 and DI2\)](#) ⁵⁰. 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 DI1 as the pulse input channel. The external power source can be any DC supply from 6 V to 15 V.



The sensor should be configured for the correct channel, scaling and logging regime as described in Section [Sensors](#) ³⁷. 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 0.5 mm tipping bucket rain gauge (TBRG) and is logged every 15 minutes for examples 1 and 2.

```

Name: Rainfall
Source: 3. Pulse In 1
Process Mode: Instant
Multiplier: 0.500
Offset: 0.0000
Log Rate: 15 mins
  
```

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.

```

Name: Rainfall
Source: 3. Pulse In 1
Process Mode: Event
Multiplier: 0.500
Offset: 0.0000
Log Rate: 15 mins
  
```

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 required.

```

Name: Rainfall
Source: 3. Pulse In 1
Process Mode: Event
Multiplier: 0.500
Offset: 0.0000
Log Rate: 0 mins
  
```

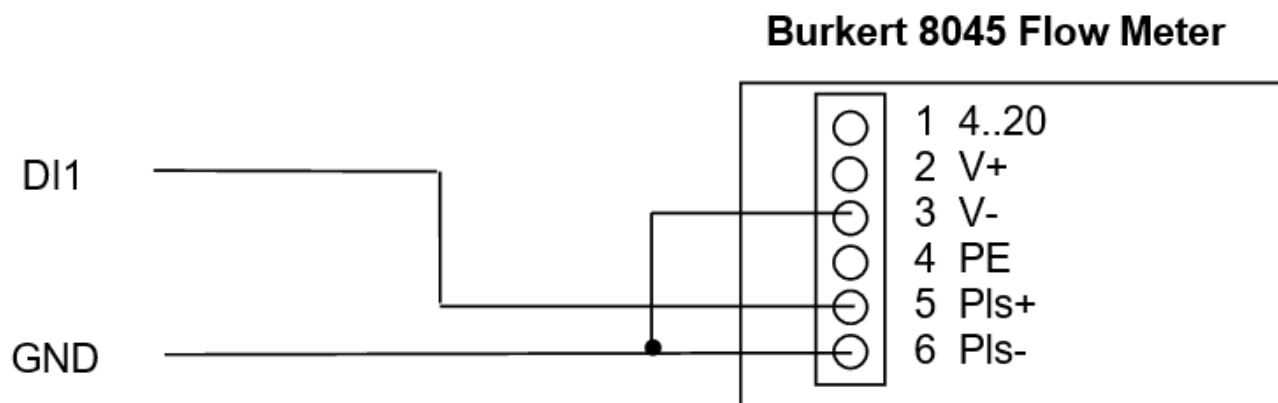
Example 3: True Event

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.

This chapter contains the following subsections:

- [Connecting a Burkert 8045 Flow Meter](#) ¹⁷
- [Connecting a Seametrics EX Flow Meter](#) ¹⁷
- [Connecting a Mace RotoFlo® Flow Meter](#) ¹⁸

2.5.1.1 Connecting a Burkert 8045 Flow Meter



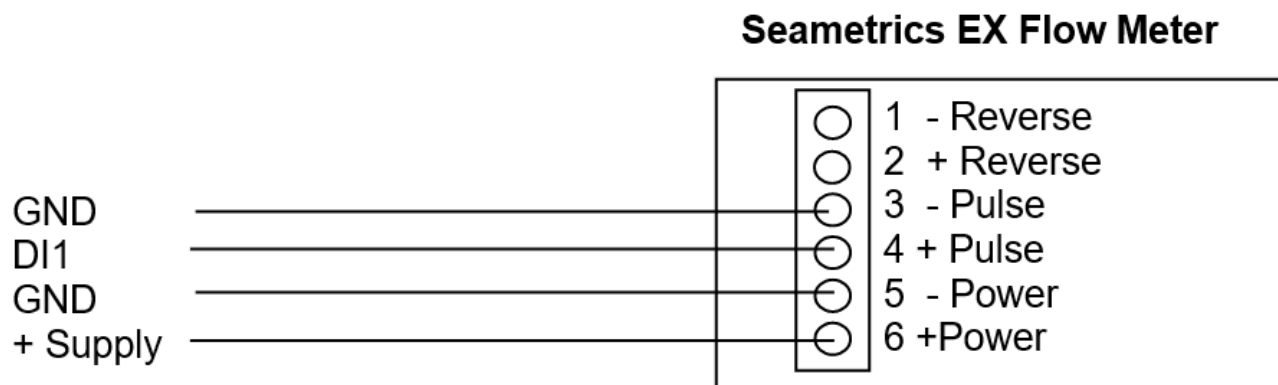
Configure the 8045 pulse value to suit. Please refer to Section 4.4.5 in the 8045 instruction manual available on the Burkert website.

<http://www.burkert.com/COM/search.php?type=8045>

The example configuration shown assumes the flow meter has been configured for one pulse = 100 litres. The basic unit of measurement is a cubic metre so each pulse is 0.1 m³, hence the multiplier of 0.1. The logging is configured for timed event mode with an interval of 15 minutes.

```
Name: Pump Vol
Source: 3. Pulse In 1
Process Mode: Event
Multiplier: 0.1
Offset: 0.0000
Log Rate: 15mins
```

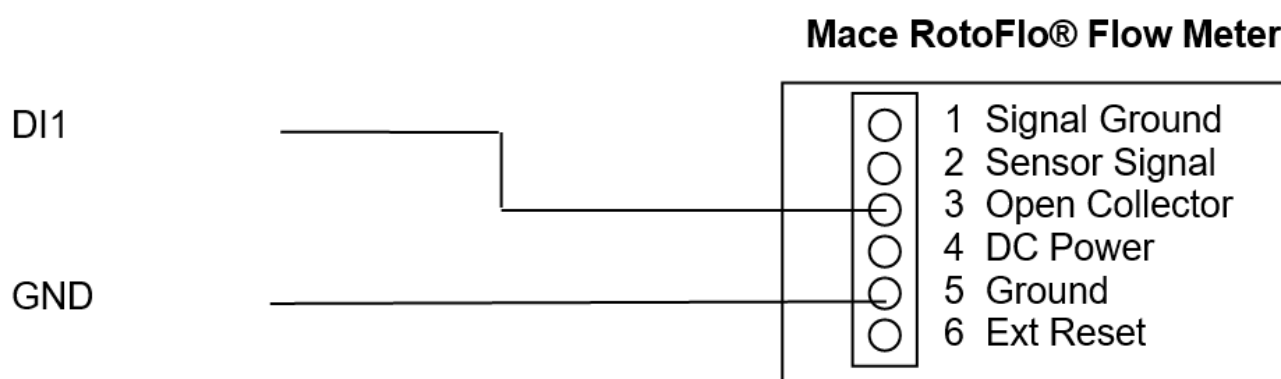
2.5.1.2 Connecting a Seametrics EX Flow Meter



The example configuration shown uses a multiplier of 0.3528 (reciprocal of K-factor of 2.834). The logging is configured for average mode with an interval of 15 minutes.

```
Name: Flow Rate
Source: 7. Frequency 1
Process Mode: Period
Average
Multiplier: 0.3528
Offset: 0.0000
Log Rate: 15 mins
```

2.5.1.3 Connecting a Mace RotoFlo® Flow Meter



The example configuration shown assumes a 150 mm ID pipe with the meter installed 150 mm from the elbow. Based on the Mace K-factor chart, a factor of 776678 per megalitre is used. Because of numeric entry limitations, this is translated to a multiplier of 0.0012785 to give the basic unit of measurement as a cubic metre (0.001 megalitre). The logging is configured for timed event mode with an interval of 15 minutes.

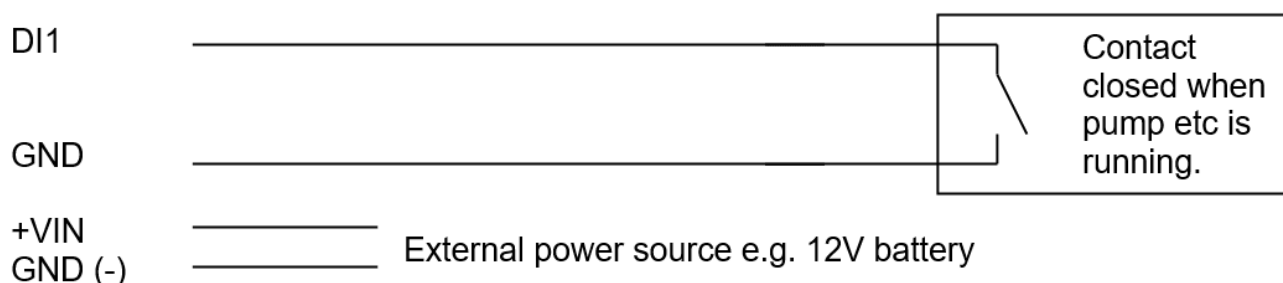
Name: Pump Vol
 Source: 3. Pulse In 1
 Process Mode: Event
 Multiplier: 0.00129
 Offset: 0.0000
 Log Rate: 15 mins

2.5.2 Simulating a Flow Meter using Auto-Pulse mode

Occasionally a flow measurement is required and there is no flow meter available. If the flow rate is relatively constant and/or accuracy is not critical, it is possible to simulate a flow rate by using the “Auto-Pulse” sensor source type.

When this source type is used, the iRIS will simulate a pulse rate of once-per-second (1 Hz) while the associated digital input is on (active). By setting the multiplier to define the rate in units per second, the iRIS will accumulate and log the value just as if it were obtained from real pulses from a physical flow meter.

The diagram below shows the typical connection diagram for such an installation. It assumes the use of DI1 as the device (pump etc) run status input. Typically this would be from a volt-free contact on an auxiliary relay that is enabled when the pump is running. The external power source can be any DC supply from 6 V to 15 V.



The sensor should be configured for the correct channel, scaling and logging regime as described in Section [Sensors](#)³⁷. Event mode (Sensor Mode = 2) can be used to reduce the quantity of data logged, especially for intermittent operation where the actual data density is low.



This mode is also useful for other applications such as accruing run-times of machinery or active time on radio channels by monitoring the busy status on a radio. In either of these cases, the multiplier is typically 1, giving an accumulated value in seconds.

This example accrues pumped volume in m^3 at a simulated pumping rate of 17 l/s ($0.017 \text{ m}^3/\text{s}$) while DI1 is active.

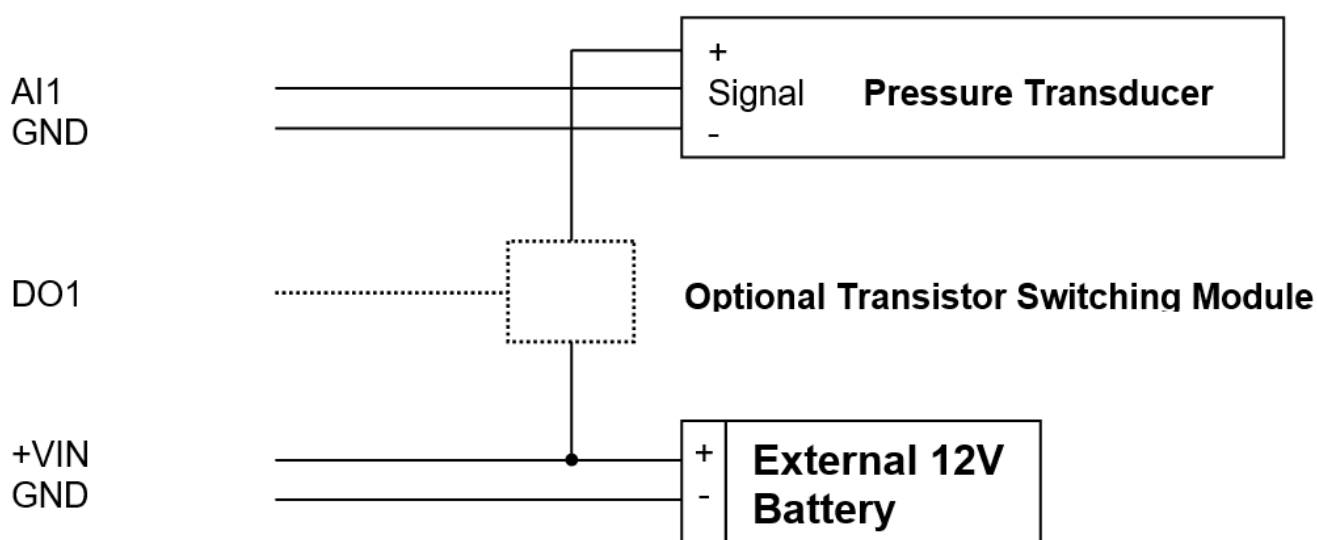
It logs the accumulated volume total every 15 minutes to two significant places, even if it is zero. This produces the most data as every “time slot” has an associated sample.

```
Name: Volume
Source: 5. Auto Pulse 1
Process Mode: Instant
Multiplier: 0.017
Offset: 0.0000
Log Rate: 15 mins
```

2.5.3 Connecting a 0 - 5 V Pressure Transducer

Connecting a standard sensor (such as a pressure transducer that provides a 0 - 5 V signal) to an iRIS is relatively straightforward. An external 12 V battery (7 A/Hr or larger) is required to power the sensor but this can optionally be controlled by the iRIS' digital output to save power.

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 a transistor switch module with control from DO1.



The sensor should be configured for the correct channel, scaling and logging regime as described in Section [Sensors](#). A typical sensor configuration example for this type of instrument is shown below. The instrument is a 10 metre, 0 - 5 V output pressure transducer. The level is averaged and the result logged every 15 minutes.

```
Name: Water Lvl
Source 1: Analog In 1
Process Mode: Period Average
Multiplier: 2.000
Offset: 0.0000
Log Rate: 15 mins
```

Note: The iRIS supports activation of the digital output with a schedule. Therefore, if further power reduction is to be achieved by controlling the transducer power, follow this procedure:

1. Install a transistor switch module in series with the transducer power lead and control it from the digital output.
2. Configure the digital output's mode to be Schedule (Mode = 0).
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 0 (Instant).

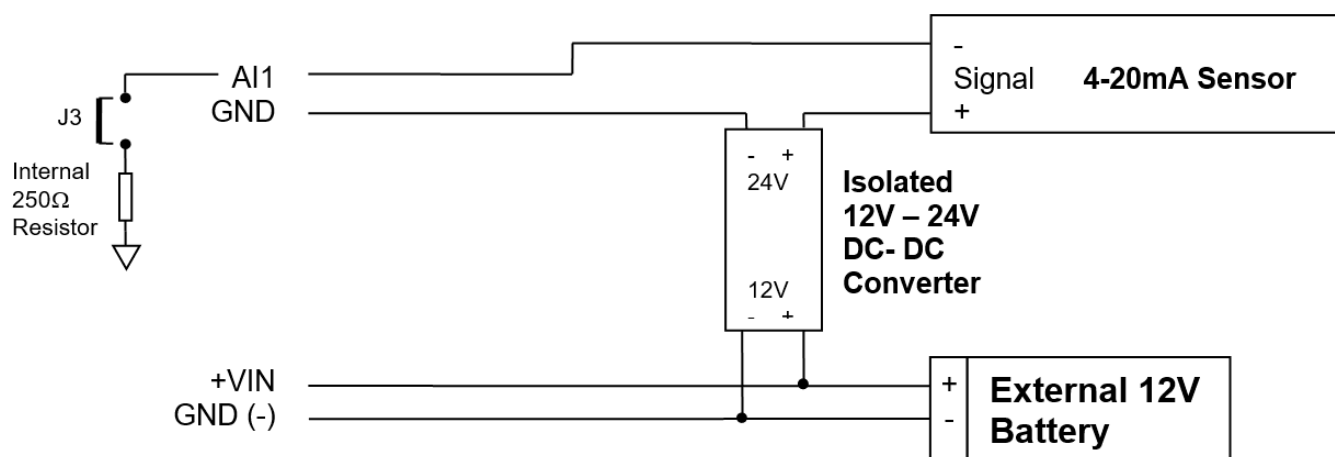
2.5.4 Connecting a 2-Wire Loop-Powered 4-20mA Sensor

The iRIS also supports the connection of many types of industry standard 4 - 20 mA 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 - 20 mA loop current provides power for the sensor as well as being the proportional analogue sensor signal.

These sensors often require a minimum voltage across them that may not be reliably achieved with a 12 V supply, taking into account the voltage drop across the sense resistor. In such cases, a separate 12 - 24 V 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 iRIS has an internal 250 Ω sense resistor that can be enabled by the use of jumpers J3 (AI1) and J4 (AI2), see section [Analogue Inputs](#) for more information. The internal sense resistor generates a 1 - 5 V signal (from the 4 - 20 mA current), which is then measured by the analogue input.



The sensor should be configured for the correct channel, scaling and logging regime as described in Section [Sensors](#). An offset value will be required as part of the configuration, as the 4 mA (1 V) offset needs to be eliminated. Use the iRIS Scaling Calculator to calculate the multiplier and offset. This is supplied with the iRIS support utility, "iLink2012" which is available from the KISTERS website at <http://www.hyquestolutions.co.nz>.

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

Name:	Water Lvl
Source:	1. Analog In 1
Process Mode:	Period Average
Multiplier:	0.003
Offset:	-2.5
Log Rate:	15 min

2.5.5 Measuring the External Supply Voltage

On occasions, it is useful to be able to measure the external supply voltage in real-time. This would typically be in a telemetered installation where absolute battery health is important and an alarm can be raised on a low level being detected at the base station.

Note: For maintaining a simple record of connection and disconnection of the external supply as a time-stamped event based record, use sensor source 11 (DC Power). See Section [Sensors](#) for more details.

The configuration differs for between the two versions of the iRIS150FX PCB. This is easily recognizable by the depth of the enclosure (deeper is the V1.2).

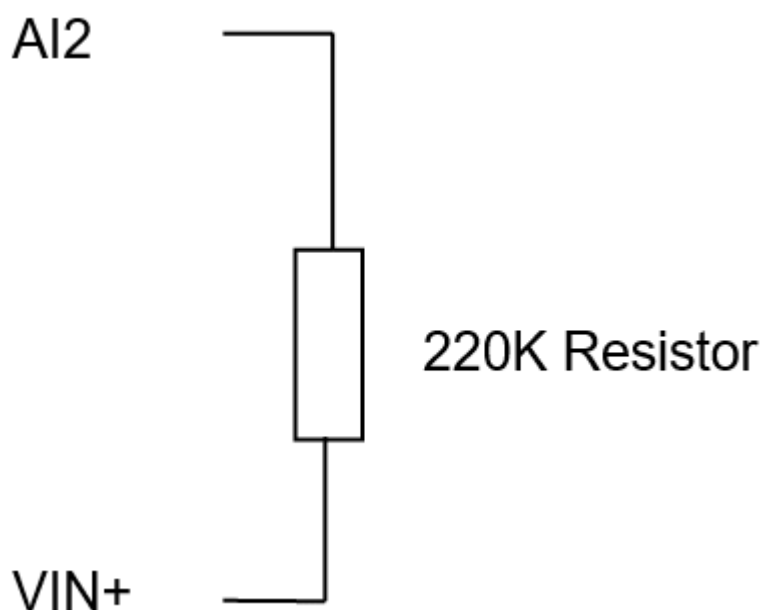
This chapter contains the following subsections:

- [PCB Version 1.1](#)
- [PCB Version 1.2](#)

2.5.5.1 PCB Version 1.1

To measure the external supply directly requires an analogue source to be configured. The voltage needs to be measured by feeding the external supply voltage via a divider resistor into one of the analogue inputs. The resistor should be 220K (220,000 ohms), 1 % and one is supplied with every iRIS 150FX.

The diagram below shows the typical connection diagram for such an installation and shows the connection of the potential divider resistor. It assumes the use of AI2 as the desired input channel. Because of the small terminals in the iRIS, this resistor is more easily mounted externally and a separate wire (or cable core) used to connect to the analogue input terminal.



Note: The analogue input's current selection jumper should be disconnected or the voltage measured will be close to zero. No damage will occur however.

The sensor should be configured like the example shown below. In this example, analogue input 2 is used. The voltage is averaged and the result logged every 60 minutes.

```
Name: Batt Volts
Source: 2. Analog In 2
Process Mode: Period
Average
Multiplier: 0.0031
Offset: 0.0000
Log Rate: 60 mins
```

2.5.5.2 PCB Version 1.2

To measure the external supply directly with the V1.2 PCB does not require an analogue source. The voltage is measured internally, this frees the analogue input.

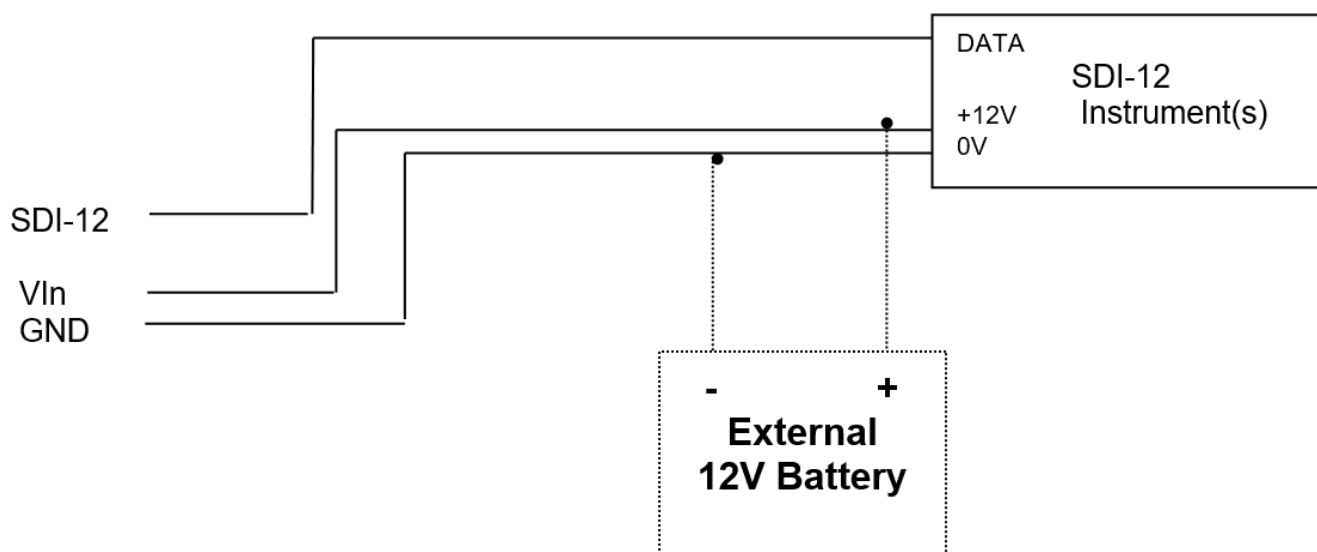
The sensor should be configured like the example shown below. In this example, the source is set to option 13 Supply. The voltage is averaged and the result logged every 60 minutes. A multiplier of 0.01 is used to convert to volts.

```
Name: Batt Volts
Source: 13. Supply
Process Mode: Period
Average
Multiplier: 0.01
Offset: 0.0000
Log Rate: 60 mins
```

2.5.6 Connecting SDI-12 Instruments

SDI-12 instruments should be connected as shown in the diagram below. See Section [SDI-12 Devices](#) for information on using the SDI-12 terminal mode to access SDI-12 instruments directly. Also, refer to [Appendix - SDI-12](#) for detail on the SDI-12 specification.

TOP **iRIS I/O Connector**



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.

```
Name: Water Lvl
Source: 12. SDI-12
Variable: 1
Process Mode: Period
Average
Multiplier: 1.000
Offset: 6.17
Log Rate: 15 mins
```



Note: The SDI-12 measurements are taken at a rate determined by the mode of the FIRST SDI-12 sensor that is defined in the iRIS. If its mode is Instant, then a measurement is initiated for all SDI-12 instruments 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, 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.

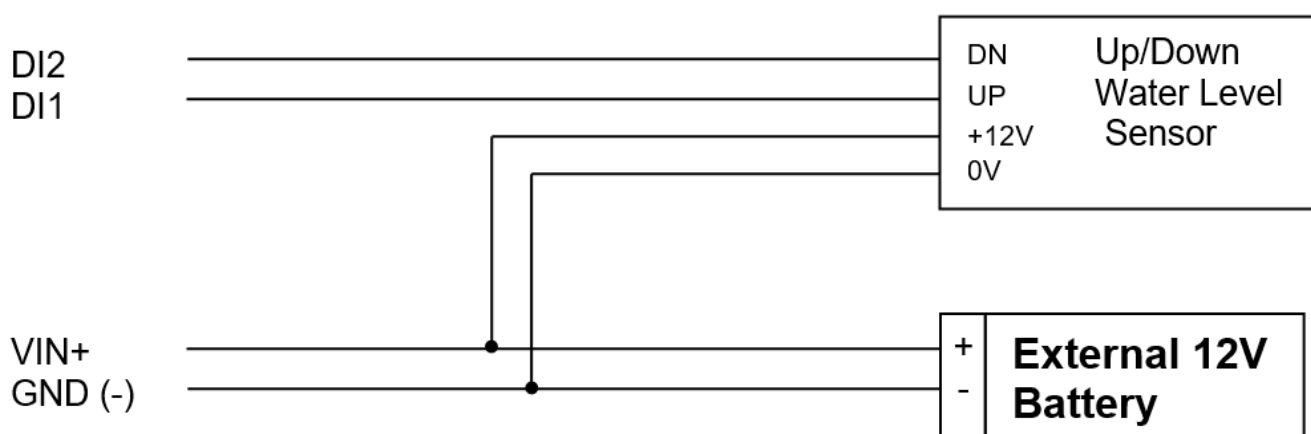
To cater for unusual situations where the combined time to take a measurement from all the SDI-12 instruments will exceed one minute, a compromise mode is provided. In this case, the SDI-12 instrument measurement cycle can be set to start two minutes before logging. **This is done by setting the address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

2.5.7 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.

These instruments normally require a 12 V supply, which can also be used to provide external power to the iRIS.

The diagram below shows the required connections 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.

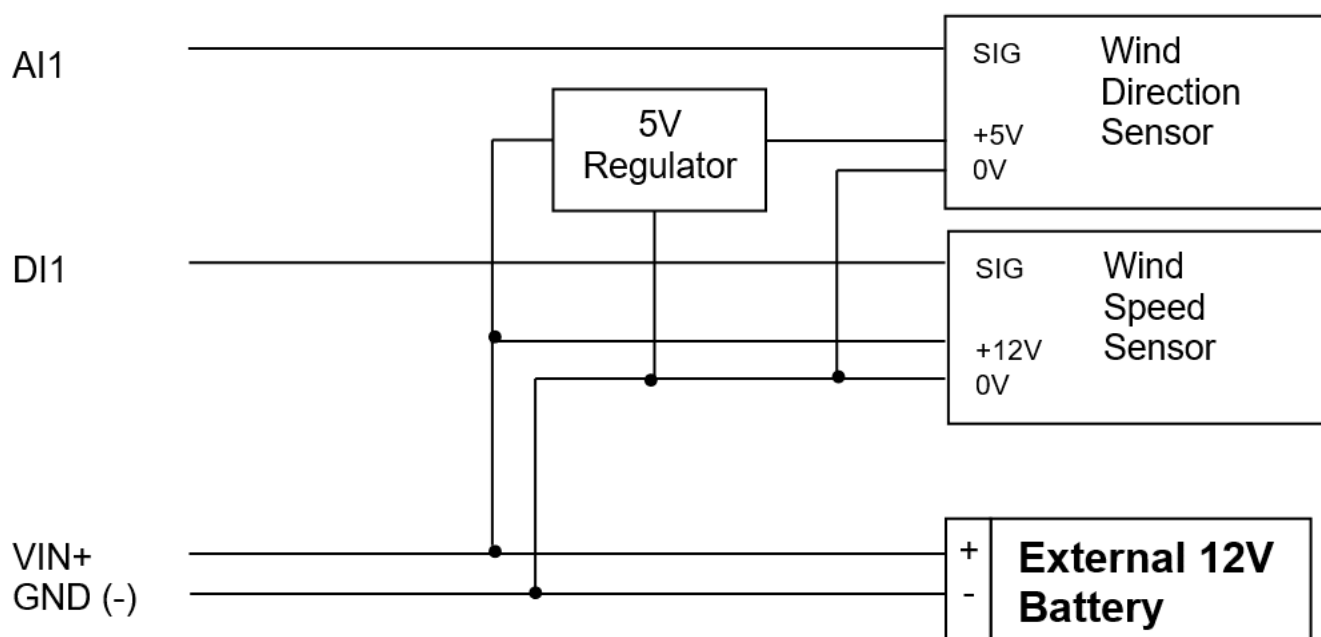
```
Name: Water Lvl
Source:      9.      Up/Down
Encoder
Process Mode: Period
Average
Multiplier: 0.001
Offset: 0.000
Log Rate: 15 mins
```

2.5.8 Connecting Analogue Wind Instruments

There are a number of wind speed and direction instruments available that interface relatively easily to the iRIS. This section describes how to connect typical mechanical wind instruments as provided by manufacturers such as Vector Instruments Ltd or NRG. The anemometer provides pulses that are measured as a frequency via a digital input. The potentiometer type wind speed instrument provides a 0 - 5 V signal measured by an analogue input. This however requires an external regulator to provide the 5 V supply.

The diagram below shows the required connections for such an installation. The wind speed sensor pulse output should be connected to a digital input (DI1 or DI2) and the wind direction sensor connected to an analogue input (AI1 or AI2).

Note also that some wind speed instruments (e.g. the Vector A101M) may require external resistors to suitably bias the internal electronics. Refer to the manufacturer's data sheet for details and the appropriate multipliers and offsets that will be needed.



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 W200P wind direction sensor. The wind speed and direction are averaged and the results logged every 10 minutes. The wind speed min and max (lull and gust) are also logged.






```
Name: Wind Spd
Source: 7. Frequency 1
Process      Mode:      Period
Average
Log Minimum: Enabled
Log Maximum: Enabled
Multiplier: 0.010
Offset: 0.000
Log Rate: 10 mins
```

```
Name: Wind Dir
Source: 1: Analog In 1
Process      Mode:      Scalar
Average
Multiplier: 0.0718
Offset: 0.000
Log Rate: 10 mins
```


3 Configuration

The iRIS configuration is done by iLink 2012 or HydroTel. A limited terminal tool is available via the RS232 port for local SDI-12 diagnostics.

This description assumes a computer running the Microsoft® Windows® operating system is being used and all examples relate to the configuration tool in iLink 2012.

- [Terminal Connection](#) 
- [Configuration Menus](#) 
- [Terminal Menus](#) 
- [Using iLink 2012's Sensor Configuration Tool](#) 
- [Upgrading Firmware/Software](#) 

3.1 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.

To access the iRIS configuration terminal session, connect a full null-modem cable (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.








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 4 – RS232 Cable Pin Designations

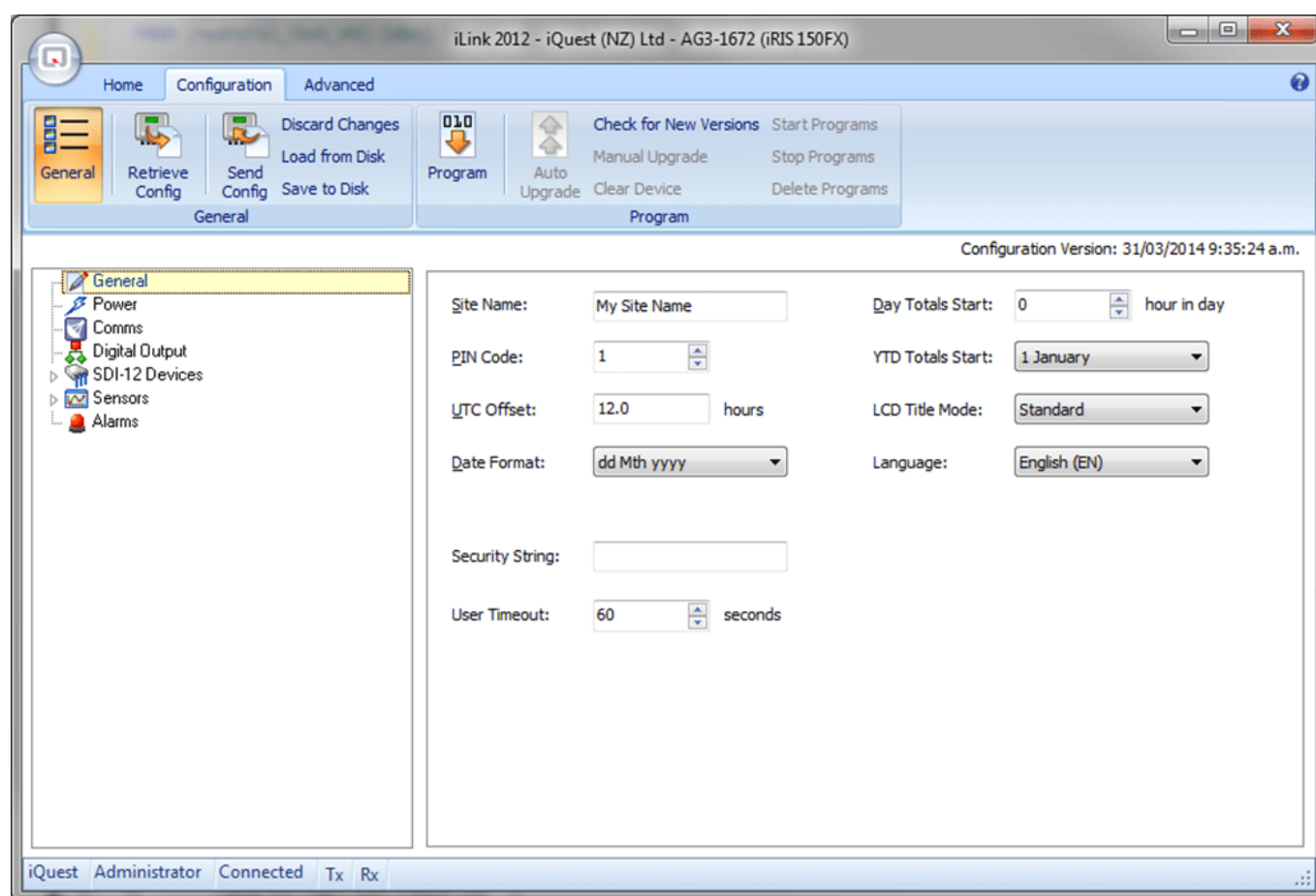
The iRIS 150FX RS232 serial port is set by default to a speed of 115200 bps.

3.2 Configuration Menus

All the configuration can be done by connecting the device using iLink 2012. Once the iRIS is connected to your computer, open up iLink 2012 and click on the 'Quick Connect' button. Select the COM port from the drop down menu and set the baud rate as 115200. When the device is connected successfully, click on the Configuration tab to see the configuration settings for the device.

- [General](#) 
- [Power](#) 
- [Comms](#) 
- [Digital Output](#) 
- [SDI-12 Devices](#) 
- [Sensors](#) 
- [Alarms](#) 

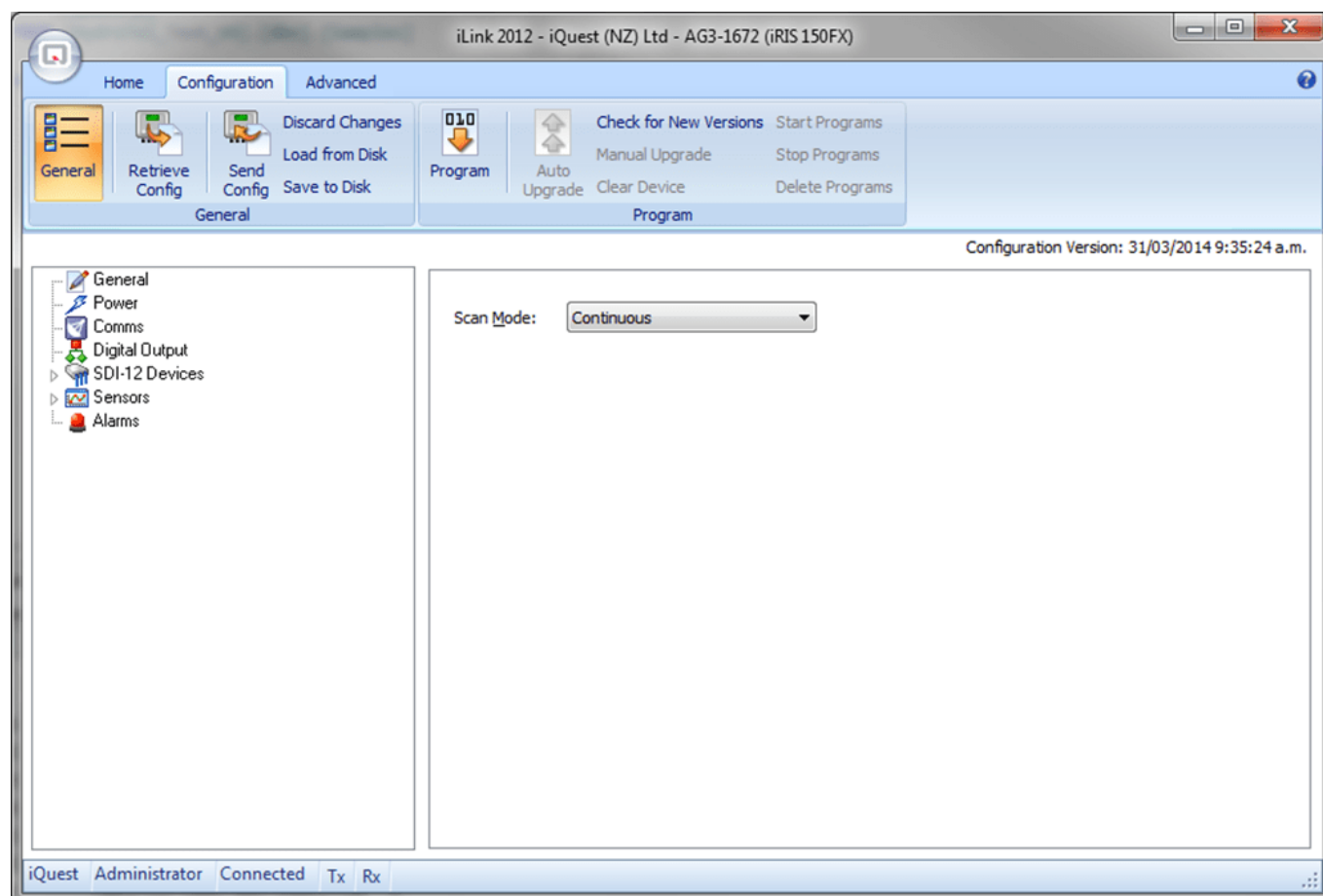
3.2.1 General



Site Name:	This setting is used to enter a name for the site that will be displayed on the main title screen of the LCD. Note that the maximum length of the site name is fixed at 19 characters.
PIN Code:	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.
UTC Offset:	Enter the UTC offset in this column.
Date Format:	Choose the date format from the drop down box.
Security String:	The Security String (of up to 10 characters) is used to prevent unauthorised access to the terminal menus. If used, the code is set using iLink 2012 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.
User Timeout:	You can set the user to be logged off automatically after a certain period of no key presses,. Enter the time in seconds in this column.
Day Totals Start:	This option allows you to enter the hour of the day to start calculating the day totals.
YTD Totals Start:	Enter the month of the year to start calculating the year to date totals.
LCD Title Mode:	Choose the LCD Title Mode - Standard or Metering.

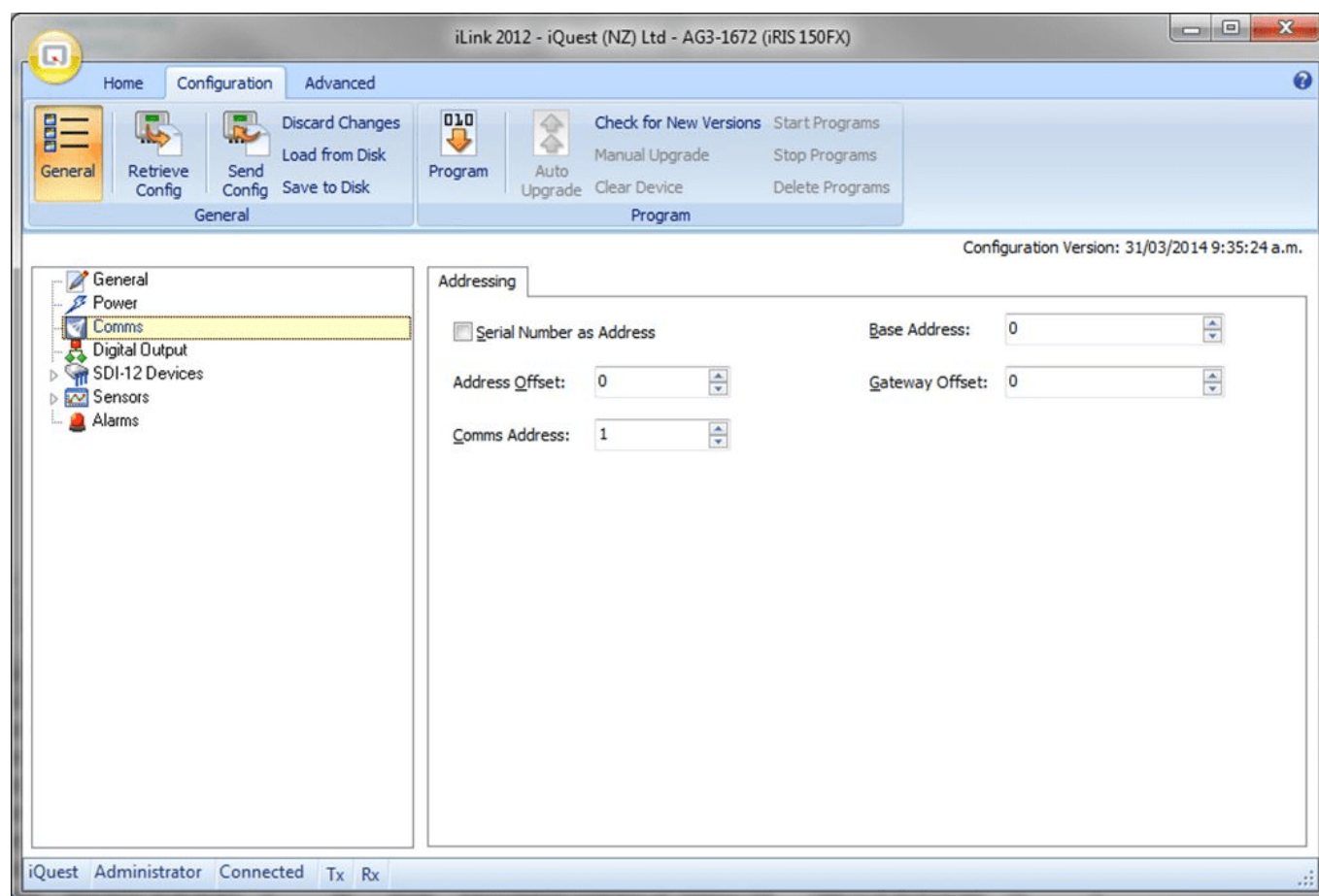
Language:	Choose the language from the available options (English, German, French, Spanish and Portuguese).
-----------	---

3.2.2 Power



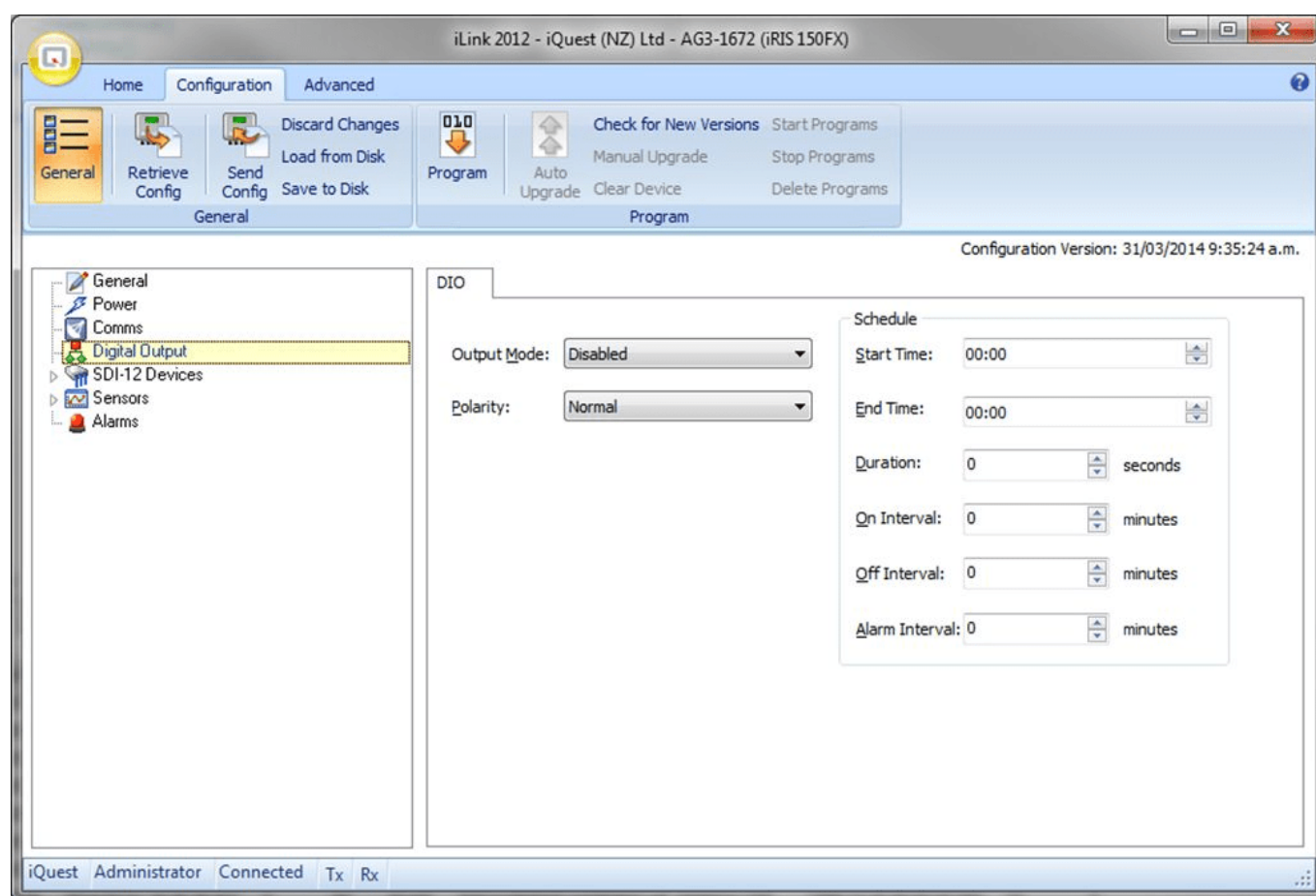
Scan Mode:	Use this option to change the scan mode of the unit. The scan rate represents the number of minutes that should elapse between successive scans when the mode is "Timed". See Section Scan Mode / Scan Rate for further information on scan modes and scan rates.
------------	---

3.2.3 Comms



Serial Number as Address:	Enable this option if you want the address to be obtained automatically from the device's serial number.
Address Offset:	If the 'Serial Number as Address' checkbox is enabled, then an optional offset can be entered which can be categorized units into regions.
Comms Address:	Enter the communication address for the device.
Base Address:	This 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.
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.

3.2.4 Digital Output



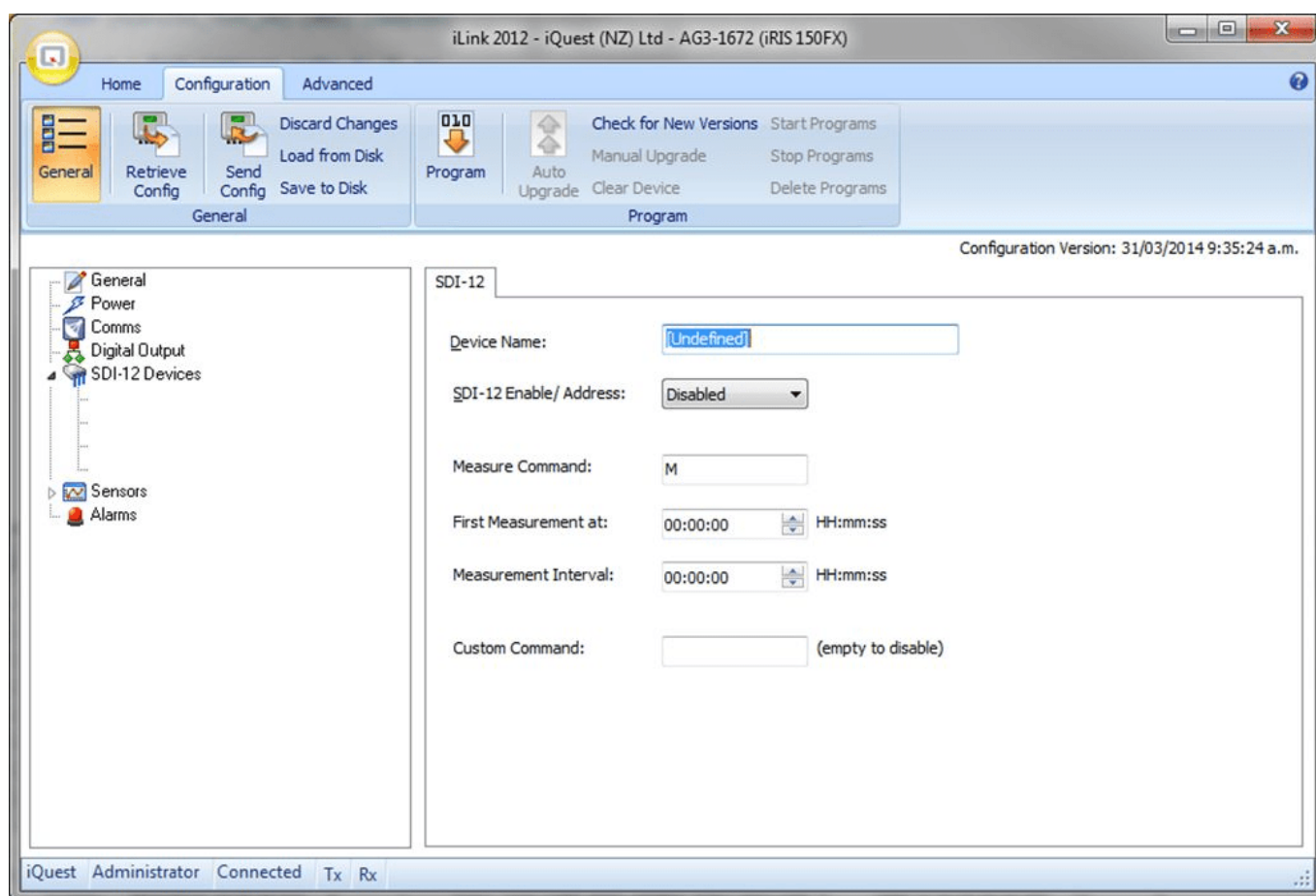
The Digital Output Config menu is used to configure the digital output.

Output Mode:	<p>Select the output mode from the list. Valid output modes are:</p> <table border="1"> <thead> <tr> <th>Mode</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Disabled</td><td>The output is forced off.</td></tr> <tr> <td>Schedule</td><td>Follows the schedule as defined by the settings in alarm config options.</td></tr> <tr> <td>Schedule Plus</td><td>The relevant output(s) will be activated when a user is logged on to allow sensor calibration or radio communication testing.</td></tr> <tr> <td>Alarm</td><td>If any alarm is active, the digital output will be on.</td></tr> <tr> <td>Remote</td><td>Remote Control from HydroTel or via a custom script.</td></tr> <tr> <td>On Transmit</td><td>Active when a data packet is being transmitted in binary protocol mode.</td></tr> </tbody> </table> <p>Table 3 – Digital Output Modes</p>	Mode	Description	Disabled	The output is forced off.	Schedule	Follows the schedule as defined by the settings in alarm config options.	Schedule Plus	The relevant output(s) will be activated when a user is logged on to allow sensor calibration or radio communication testing.	Alarm	If any alarm is active, the digital output will be on.	Remote	Remote Control from HydroTel or via a custom script.	On Transmit	Active when a data packet is being transmitted in binary protocol mode.
Mode	Description														
Disabled	The output is forced off.														
Schedule	Follows the schedule as defined by the settings in alarm config options.														
Schedule Plus	The relevant output(s) will be activated when a user is logged on to allow sensor calibration or radio communication testing.														
Alarm	If any alarm is active, the digital output will be on.														
Remote	Remote Control from HydroTel or via a custom script.														
On Transmit	Active when a data packet is being transmitted in binary protocol mode.														
Polarity:	The polarity relates to the output's electrical state with respect to its logical on/off state.														

	<p>If the polarity setting is normal, the output will actively pull down to 0 V when the output logical state is on and be high impedance (open-circuit) when the output is logically off.</p> <p>If the polarity setting is inverted, the output will be high impedance (open-circuit) when the output logical state is on and be actively pulled down to 0 V when the output is logically off.</p>
Start Time:	Enter the time at which the iRIS is allowed to start controlling the output if the mode is set to Schedule.
End Time:	This is the time at which the iRIS must stop controlling the output if the mode is set to Schedule.
Duration:	Enter the length of time in seconds that you want the iRIS to keep the output energised if the mode is set to Schedule.
Interval:	Enter the length of time in minutes between the successive operations of the output if the mode is set to Schedule.
Alarm Interval:	Enter the length of time in minutes between the successive operations of the output if there are one or more active alarms in the iRIS.

3.2.5 SDI-12 Devices

This menu option will only appear when one or more sensors have a source set to SDI-12.



Device Name:	Enter the SDI-12 device name.
SDI-12 Enable/Address:	This option allows you to either disable the SDI-12 sensor or set the address of the SDI-12 sensor source.

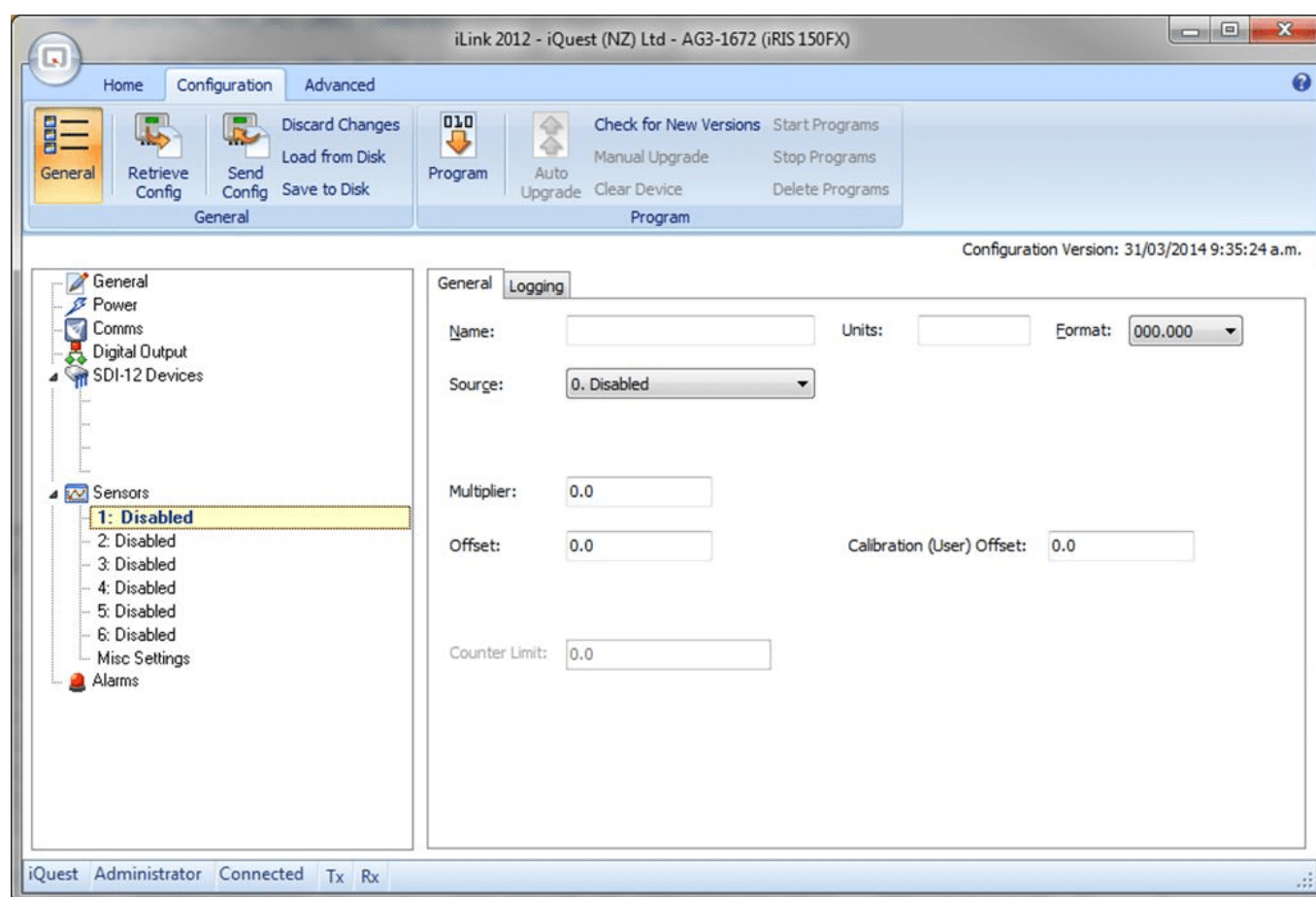
Measure Command:	Here you enter the SDI-12 Measure Command.
First Measurement at:	Enter the time of first measurement.
Measurement Interval:	This is the time interval between each measurement.

3.2.6 Sensors

The sensor configuration menu is used to configure each of the six main virtual sensors. Refer to the datalogging features ([Logged Data Array Identification](#)) of this manual for a discussion on virtual sensors.

- [General](#)
- [Logging](#)
- [Misc Settings](#)

3.2.6.1 General



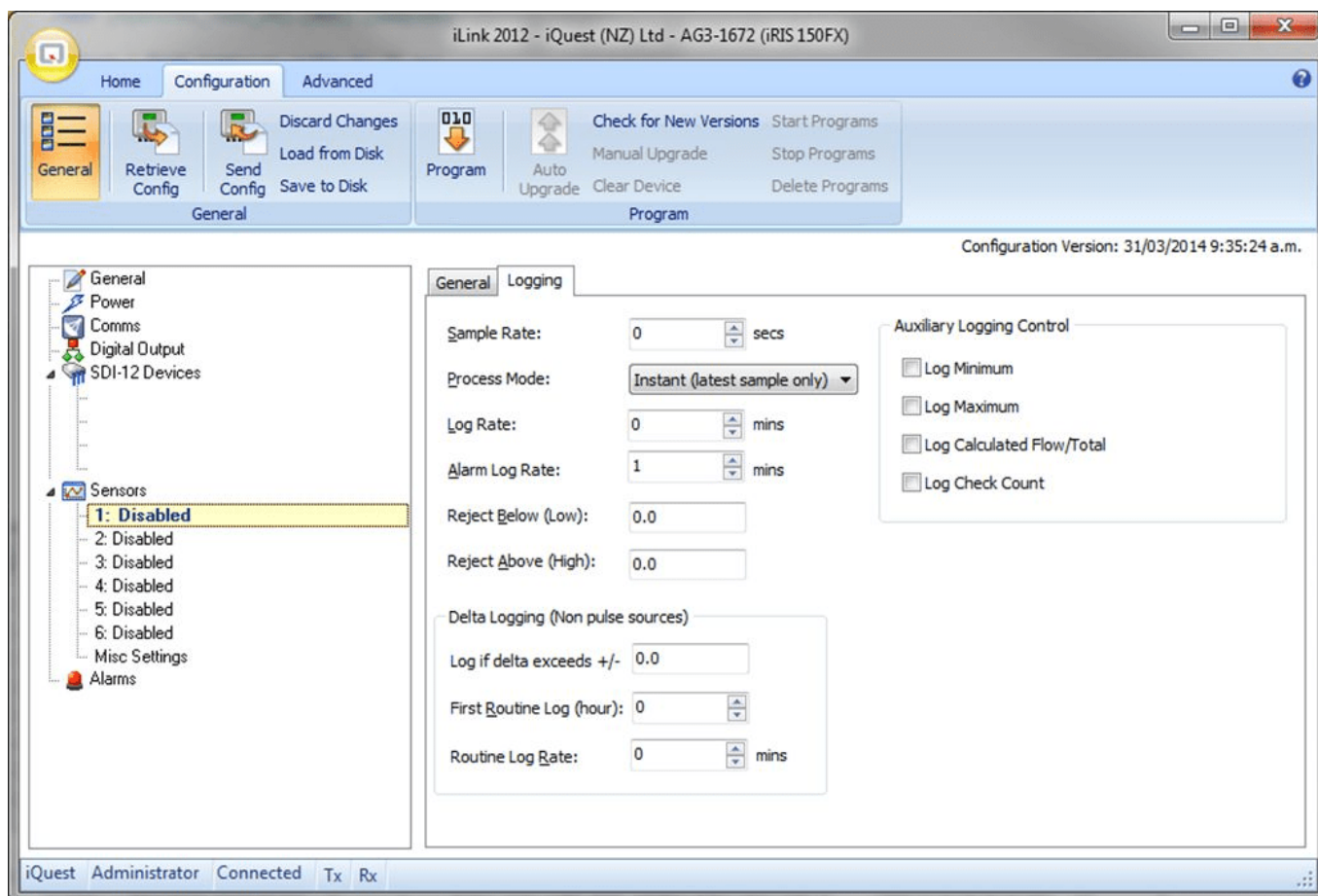
Name:	Enter a name for the sensor (maximum 10 characters). This name is displayed on the applicable iRIS LCD sensor screens and also to identify the unloaded data.
Units:	Enter the engineering units of the selected sensor.
Format:	This is the display format to use for the selected sensor.
Source:	Enter the source from which the virtual sensor should acquire its data. Use zero to disable the sensor. A list of the valid data sources is shown in the following table.

Source	Description	Raw Range	Multiplier	Offset
0	Unused / disabled	N/A	N/A	N/A
1	Analogue Input 1	0 to 5000		
2	Analogue Input 2	0 to 5000		
3	Pulse Counter on Digital Input 1	0 to 1		
4	Pulse Counter on Digital Input 2	0 to 1		
5	Auto Pulse Counter on Digital Input 1 (Simulates a regular pulse every second while DI1 is active).	0 to 1		
6	Auto Pulse Counter on Digital Input 2 (Simulates a regular pulse every second while DI2 is active).	0 to 1		
7	Frequency Counter on Digital In 1	0 to 5000Hz		
8	Frequency Counter on Digital In 2	0 to 5000Hz		
9	Up/Down Counter on Digital Ins 1 & 2			
10	Database Location	-32768 to 32767		
11	Floating Point Database Location			
12	SDI-12			
13	Supply Voltage	0 - 1605	0.01	0
14	Temperature		0.1	0
15	Change of State 1			
16	Change of State 2			
17	Day to Now Total 1			
18	Day to Now Total 2			
19	Year to Date Total 1			
20	Year to Date Total 2			

Table 4 - Sensor Sources

Multiplier:	Here you can enter a scaling multiplier. This multiplier is used to convert the raw input into engineering units.
Offset:	Enter a scaling offset. This offset is added to the scaled engineering value.
Calibration Offset: (User)	This is the offset to shift the scaled value's datum.

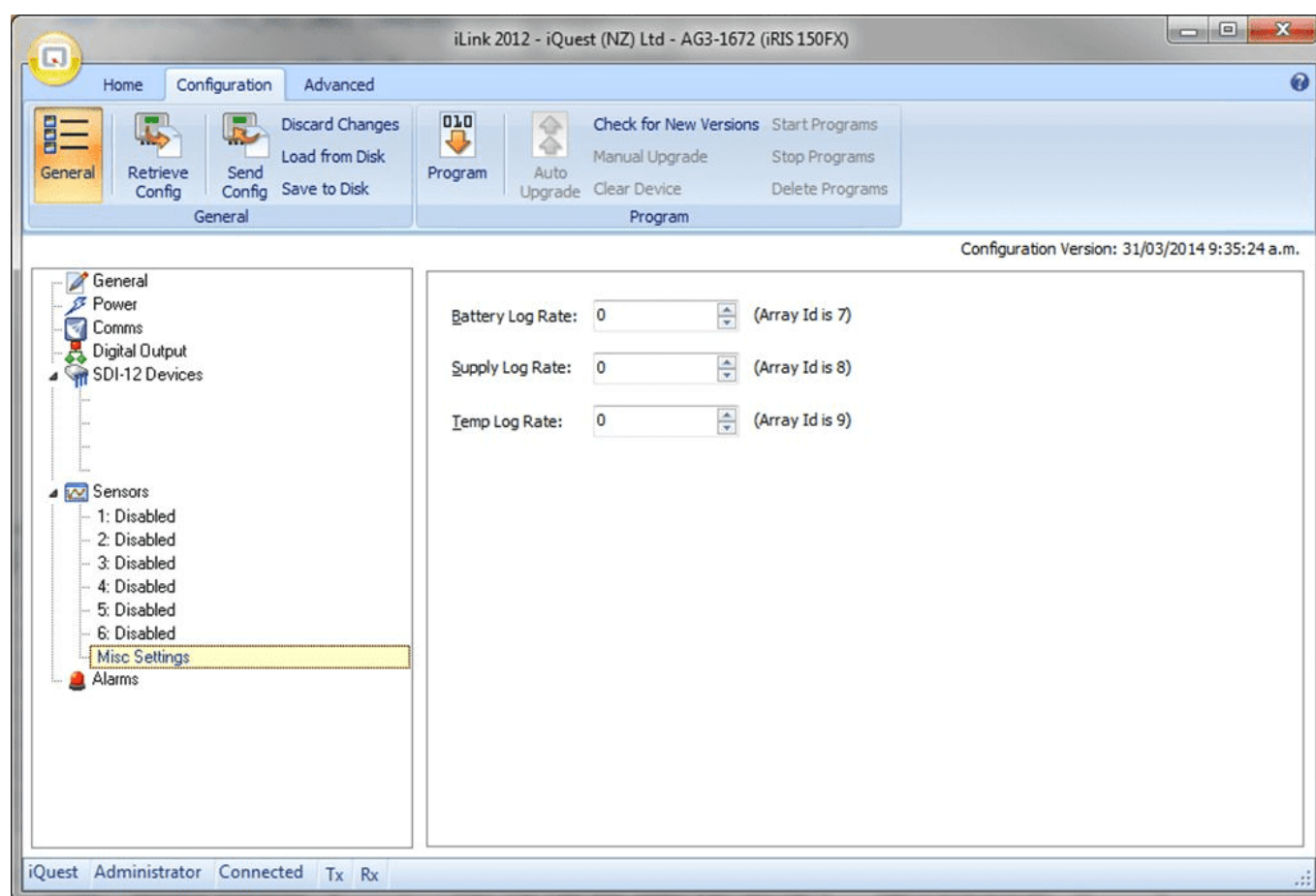
3.2.6.2 Logging



Sample Rate:	The sample rate is the rate (in secs) at which the source is sampled.								
Process Mode:	<p>Choose the process mode from the list. The available modes are:</p> <table border="1"> <thead> <tr> <th>Name</th><th>Description</th></tr> </thead> <tbody> <tr> <td>Instant</td><td>Logs only the most recent sample</td></tr> <tr> <td>Period Average</td><td>Logs the average of all samples taken over logging period</td></tr> <tr> <td>Event</td><td> <p>(Only valid for pulse input sources) Logs non-zero samples.</p> <p>If the logging rate is 0, then any pulse is logged immediately.</p> <p>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</p> </td></tr> </tbody> </table>	Name	Description	Instant	Logs only the most recent sample	Period Average	Logs the average of all samples taken over logging period	Event	<p>(Only valid for pulse input sources) Logs non-zero samples.</p> <p>If the logging rate is 0, then any pulse is logged immediately.</p> <p>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</p>
Name	Description								
Instant	Logs only the most recent sample								
Period Average	Logs the average of all samples taken over logging period								
Event	<p>(Only valid for pulse input sources) Logs non-zero samples.</p> <p>If the logging rate is 0, then any pulse is logged immediately.</p> <p>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</p>								

	Name	Description
		log time, a zero sample is also logged, time stamped with last log time/date. This is required for time series management purposes.
	Scalar Average (for Wind Direction)	Logs the average of all samples taken over logging period, but uses scalar calculations to calculate the average.
	One Minute Average	Logs the average of all samples taken over last minute prior to logging
Table 5 – Sensor Modes		
Log Rate:	This is the logging rate (in mins) when the sensor is not in alarm. If you wish to log digital data on change of state you can enter a value of 0. If this parameter is left at 0 for analogue sources, they will not be logged. The DC power change of state ignores this parameter, so it is typically set to zero for this source as well.	
Alarm Log Rate:	This is the logging rate (in mins) when the sensor is in alarm.	
Reject Below (Low):	This option is used to enter a simple rejection value. Any value equal to or below this will be ignored and the last “good” value retained.	
Reject Above (High):	Any value equal to or above this will be ignored and the last “good” value retained.	
Log if delta exceeds +/-:	<p>This is the amount the latest processed value (in actual engineering units of the sensor) must differ from the last logged value in order to be logged.</p> <p>The delta logging (if enabled by having a non-zero set-point) is done at the time the logging would normally occur for the sensor as configured. All the delta decision does look at the last value that was actually logged and compare it to the newly processed sample value. If the difference is greater than the configured delta value, then the sample is actually logged.</p>	
First Routine Log (hour):	This is the hour in the day when the first routine log will occur.	
Routine Log Rate:	The routine log rate is the interval at which a routine log is taken after the first hour is reached.	
Auxiliary Logging Control:	<p>You can also configure the extended datalogging options using the logging flags. The list of the available flags are given below.</p> <ol style="list-style-type: none"> 1. Log Minimum value sampled in the log period. 2. Log Maximum value sampled in the log period. 3. Log Calculated Flow Rate over log period or Log Accumulated Volume over log period. 4. Log Check Count. 	

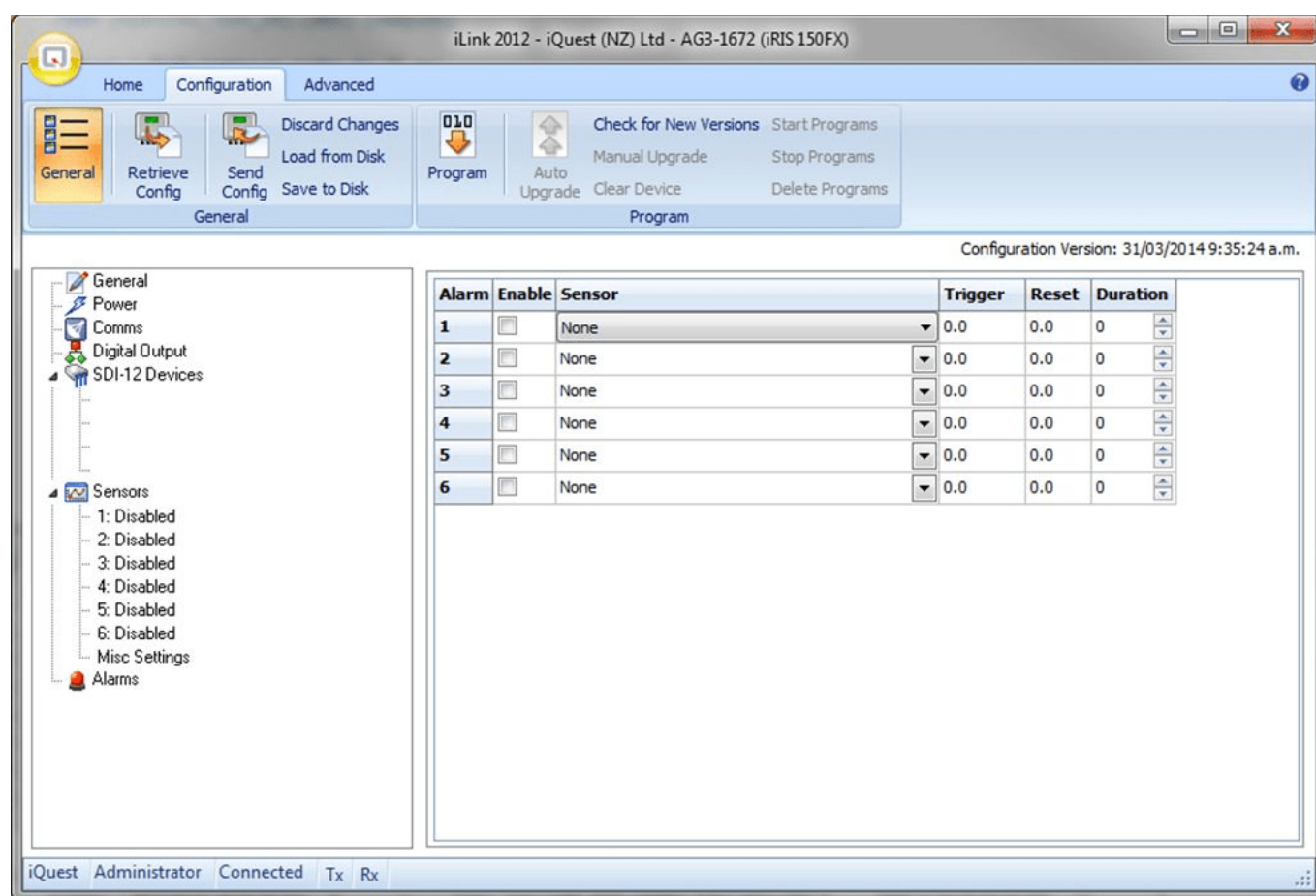
3.2.6.3 Misc Settings



This menu covers the miscellaneous configuration items.

Battery Log Rate:	The battery voltage logging can be enabled by setting a log rate (in minutes) via this option. Battery voltage data logged this way has an array ID of 7.
Supply Log Rate:	The supply voltage can be logged without occupying a normal sensor. This is enabled by setting a log rate (in minutes) via this option. Supply voltage data logged this way has an array ID of 8.
Temp Log Rate:	The logger temperature can be logged without occupying a normal sensor. This is enabled by setting a log rate (in minutes) via this option. Temperature data logged this way has an array ID of 9.

3.2.7 Alarms

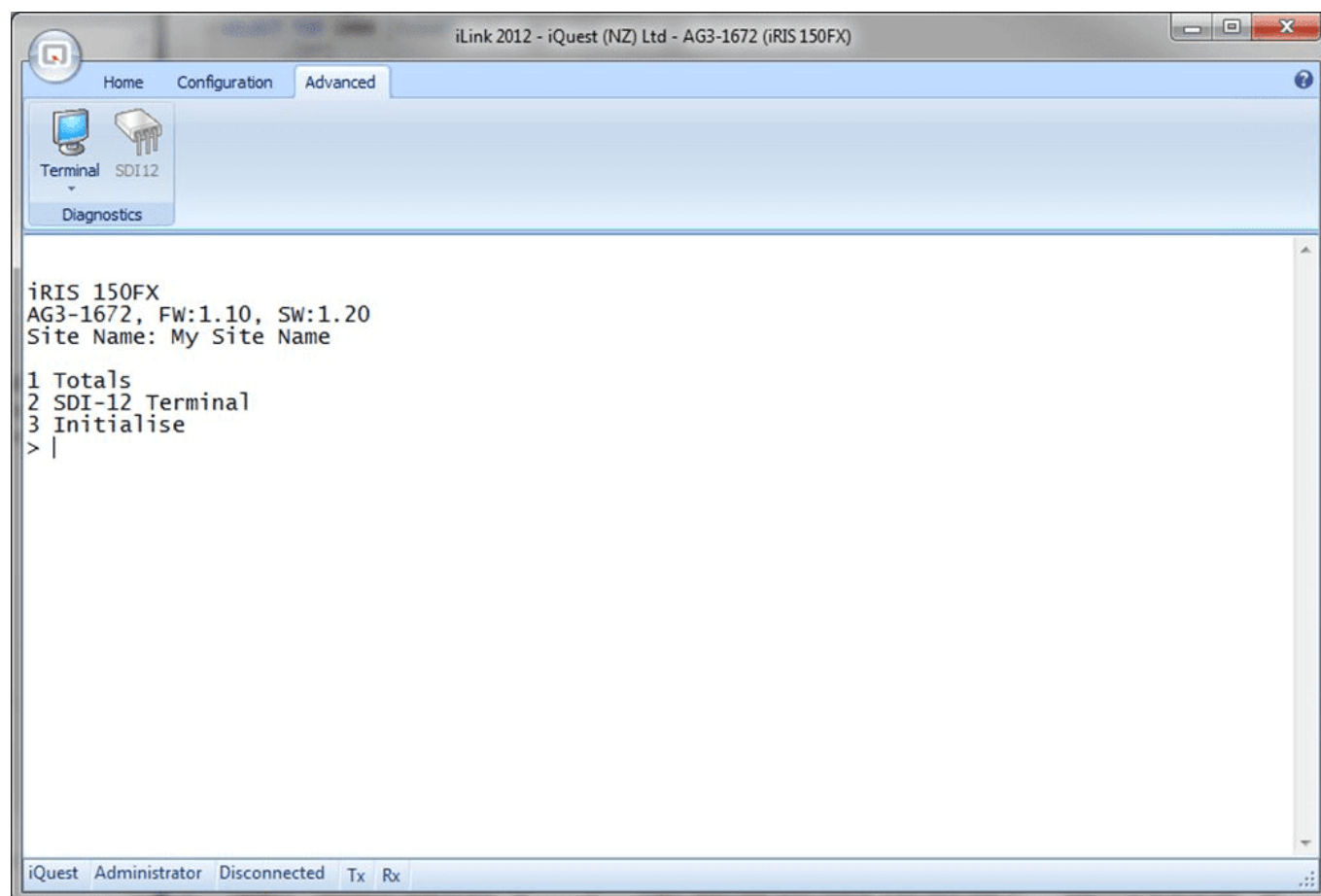


Use the Alarms menu to decide which of the six alarms you want to configure.

Enable:	Tick the box in the ENABLE column to enable an alarm.
Sensor:	Choose the sensor which you want to activate the alarm for from the list.
Trigger:	In this column, enter a value in engineering units that you want to use as the trigger point for the alarm. When the scaled value exceeds the limit the alarm will become active.
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 low water level type alarms.
Duration:	Enter a time in seconds to delay alarm activation. This can be used to implement hysteresis for analogue data sources. 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.

3.3 Terminal Menus

The Terminal menu can be accessed by clicking on the Terminal button under the Advanced Tab in iLink 2012. You can see three menu options - Totals, SDI-12 Terminal and Initialise. To make a menu selection, type a number followed by [ENTER].



Option 1

Select this option to display the Totaliser sub-menu. This allows the running total of the two totalisers to be viewed and adjusted if desired to match.

Totaliser Sub-Menu

```
0 Exit
1 Totaliser 1
2 Totaliser 2
```

Enter '0' to Exit, '1' to view or edit Totaliser 1 Configuration or '2' to view or edit Totaliser 2 Configuration.

Totaliser 1 Cfg

```
Last Year:      0.0
Year To Date:  0.0
Yesterday:     0.0
Today:         0.0
Running:       0.0

0 Exit
1 Reset All Totals
```

2 Edit Running Total

Enter '0' to Exit, '1' to Reset All Totals for Totaliser 1 or '2' to Edit Running Total.

Reset All Totals

```
> Reset ALL Totals for Totaliser 1? (0:No 1:Yes)
```

Enter '0' to cancel resetting the totals or '1' to confirm resetting all the totals.

Edit Running Total

```
> Totaliser 1 Running Total=
```

Enter the Running Total value here and press **[ENTER]**.

Option 2

The SDI-12 terminal mode allows direct access to instruments connected to the SDI-12 interface. Knowledge of SDI-12 commands is required to make best use of this feature.

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

Two special lower case character non-SDI-12 commands have been added to give flexibility on the legacy SDI-12 timing. This applies only to the current terminal session.

```
s - Sets the SDI-12 timing to standard (old timing value 2573)
l - Sets the SDI-12 timing to long (old timing value 20000)
```



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

Option 3

This option allows you to initialise the unit before deployment. This resets the totalisers and also the logging memory. This is useful to eliminate invalid samples that may have been logged prior to commissioning or if the unit has been reconfigured and deployed in a different location. Type 'init' (in lower case, without the quotes), at the prompt to confirm this action.

```
> WARNING! This will completely clear logged data and totals.
Type 'init' to initialise the unit. Or Enter to exit.
=
```

The unit will acknowledge the request as shown and return to the main menu.

```
Unit has been initialised.
Totals and pointers reset.
```

3.4 Using iLink 2012's Sensor Configuration Tool

To optimise the process of maintaining multiple iRIS 150FX installations with the same (or similar) sensor configuration, iLink 2012 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.

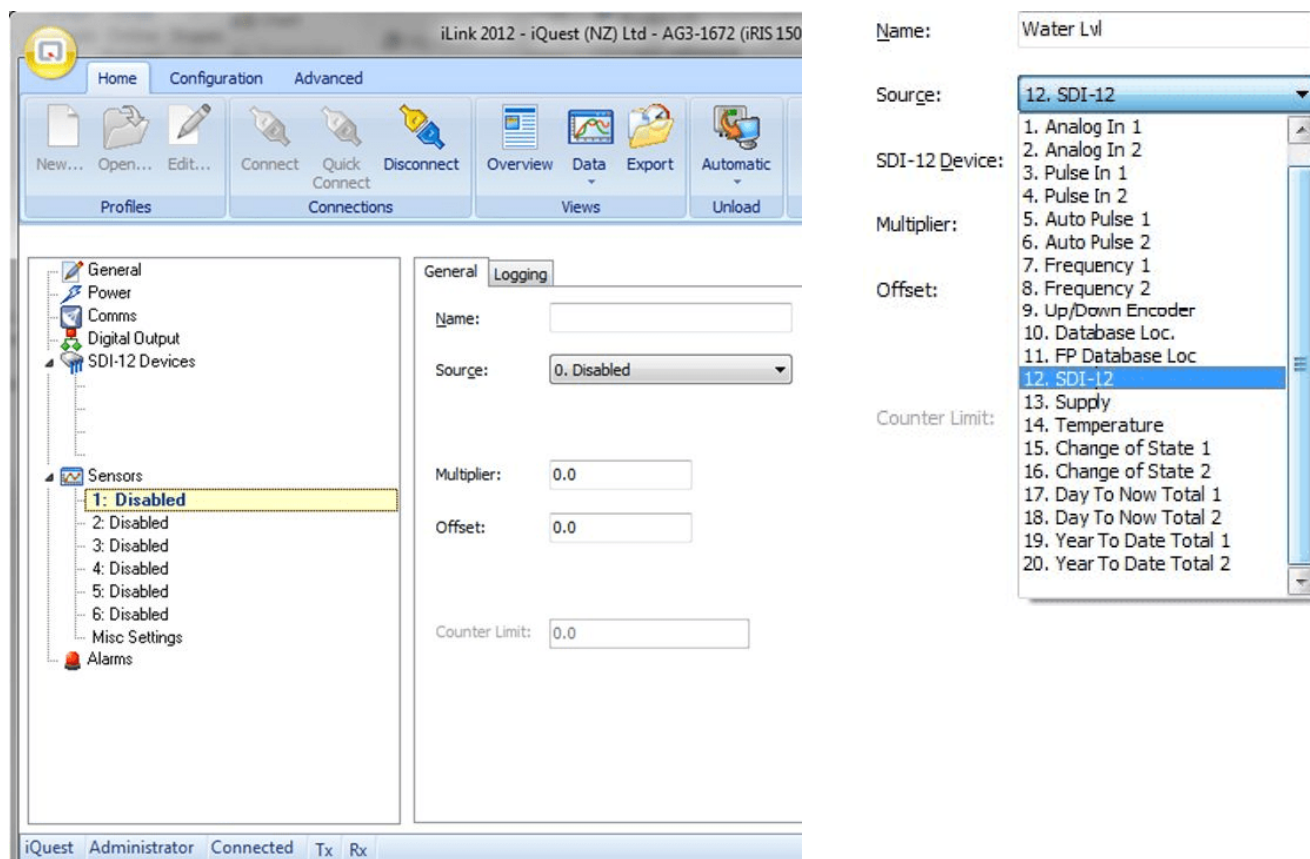
This chapter contains the following subsections:

- [iRIS Sensor Configuration Example](#)

3.4.1 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 150FX using iLink 2012.
2. Invoke the iRIS 150FX configuration form by clicking the '**GENERAL**' button under the Configuration section in the main tool bar.
or by selecting the menu item **CONFIGURATION** > **GENERAL**. Selecting the 'Sensors' node will bring up the iRIS Sensor Configuration form as shown here.



3. Next, 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 12, 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).
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.
6. The General configuration should now look like this.

Name:	Water Lvl	Units:	
Source:	12. SDI-12		
SDI-12 Device:	Device 1	Variable:	1
Multiplier:	1.0		
Offset:	0.0		

7. Now select the **"LOGGING"** tab and set up the logging parameters. In this example we are measuring averaged water level in metres. 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.

Sample Rate:	60	secs	Auxiliary Logging Control <input checked="" type="checkbox"/> Log Minimum <input checked="" type="checkbox"/> Log Maximum <input type="checkbox"/> Log Calculated Flow/Total <input type="checkbox"/> Log Check Count
Process Mode:	Instant (latest sample only)		
Log Rate:	15	mins	
Alarm Log Rate:	1	mins	
Reject Below (Low):	0.0		
Reject Above (High):	20		

9. Next select the **"ALARMS"** node. 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 Alarm configuration should look like this.

Alarm	Ena	Sensor	Trigg	Res	Durat
1	<input checked="" type="checkbox"/>	1: Water Lvl	▼	3.5	3.6 0
2	<input checked="" type="checkbox"/>	1: Water Lvl	▼	17	16.9 0
3	<input type="checkbox"/>	None	▼	0.0	0.0 0
4	<input type="checkbox"/>	None	▼	0.0	0.0 0
5	<input type="checkbox"/>	None	▼	0.0	0.0 0
6	<input type="checkbox"/>	None	▼	0.0	0.0 0

- The sensor configuration is complete. Now enter the logger's site name in the Site Name field in the General section 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.
- Save the configuration to disk by clicking the **[SAVE TO DISK]** button. Enter a suitable name for your configuration. Our example here will use the file name "SDI-12 Level and Battery.iris150FXcfg". The file can then be opened and sent to other loggers requiring the same sensor configuration at a later date.
- Finally, send the configuration to the connected iRIS. To do this, click the **[SEND CONFIG]** button.
- 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.
- 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.

3.5 Upgrading Firmware/Software

This chapter contains the following subsections:

- [Overview](#) ⁴¹
- [File Naming Conventions](#) ⁴¹
- [iRIS Automated Upgrade Procedure](#) ⁴²
- [iRIS Manual Upgrade Procedure](#) ⁴³

3.5.1 Overview

This section describes the procedure to use when upgrading firmware/software components in an iRIS 150FX.



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.

3.5.2 File Naming Conventions

This chapter contains the following subsections:

- [iRIS 150FX Executive Firmware](#) ⁴¹
- [iRIS 150FX Application Software](#) ⁴²

3.5.2.1 iRIS 150FX 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 2012.

The upgrade file is in the format:

iRIS150FX_Firmware_xxx.bin where:

xxx is the firmware version

e.g. **iRIS150FX_Firmware_130.bin** iRIS 150FX Firmware, Version Vn/1.30

The default repository for the firmware files is C:\ProgramData\iQuest\iLink2\Programs.

3.5.2.2 iRIS 150FX 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 150FX.

The software upgrade file is in the format:

iRIS150FX_NoModem_Std_xxx.y.150fx where:

xxx is the software version

y is the program bank that this file will be loaded into.

e.g. **iRIS150FX_NoModem_Std_130_1.150fx** iRIS 150FX Software, Version 1.30, Bank 1

The default repository for the firmware files is C:\ProgramData\iQuest\iLink2\Programs.

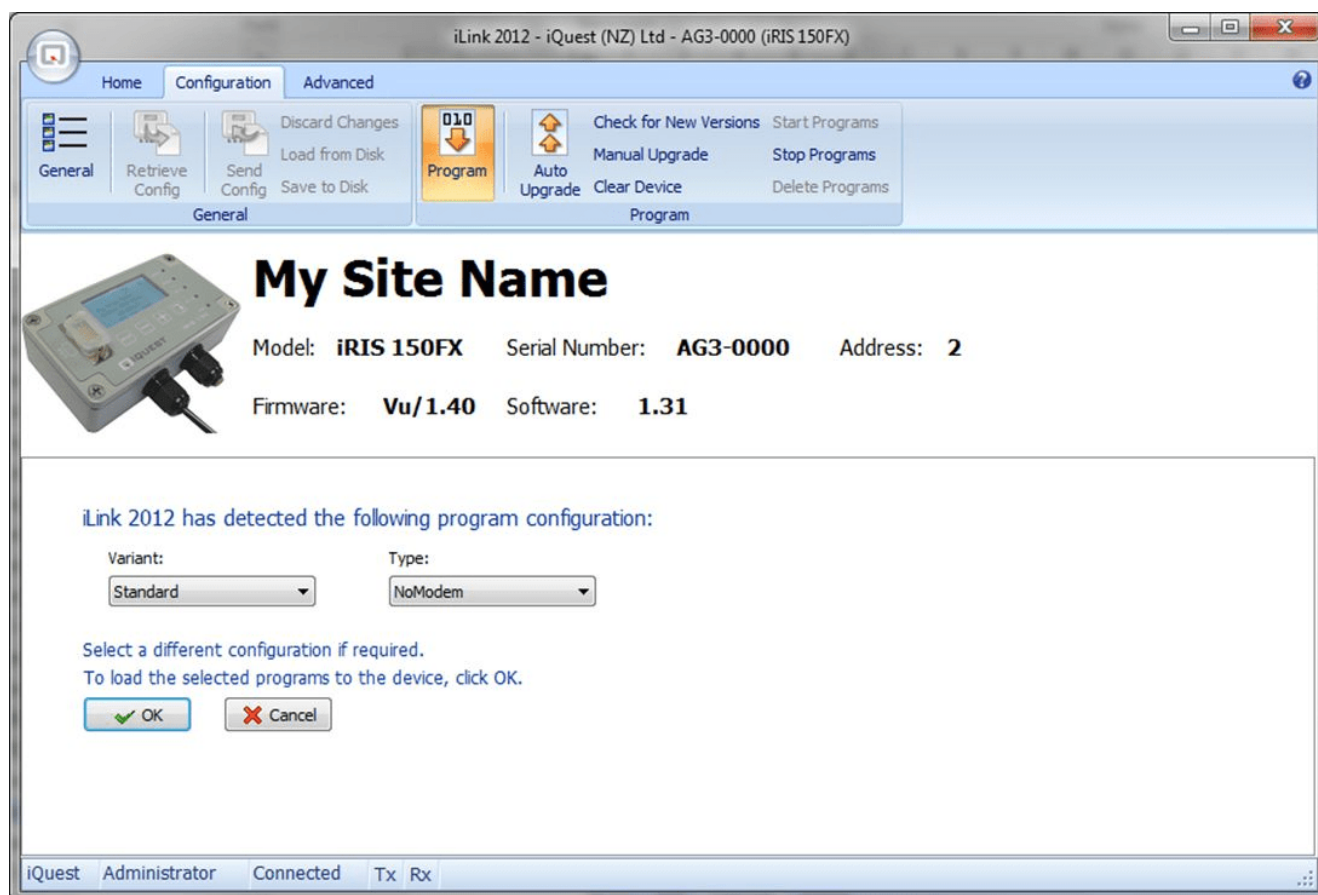
3.5.3 iRIS Automated Upgrade Procedure

iLink 2012 has an automated firmware/software upgrade tool that supports the iRIS 150FX. 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.

The example given below shows a full, automatic firmware and software upgrade for an iRIS 150FX.

1. 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 [File Naming Conventions](#)^{4th}.
2. Connect to the iRIS using iLink 2012.
3. Click on the Auto Upgrade button under the Configuration tab.
4. The iLink 2012 will automatically detect the variant and type of the device and these fields will be populated with the appropriate configuration. If required, please select a different configuration from the drop down list.
5. Click OK to load the selected programs to the device. The progress of the upgrade can be seen on the status bar.

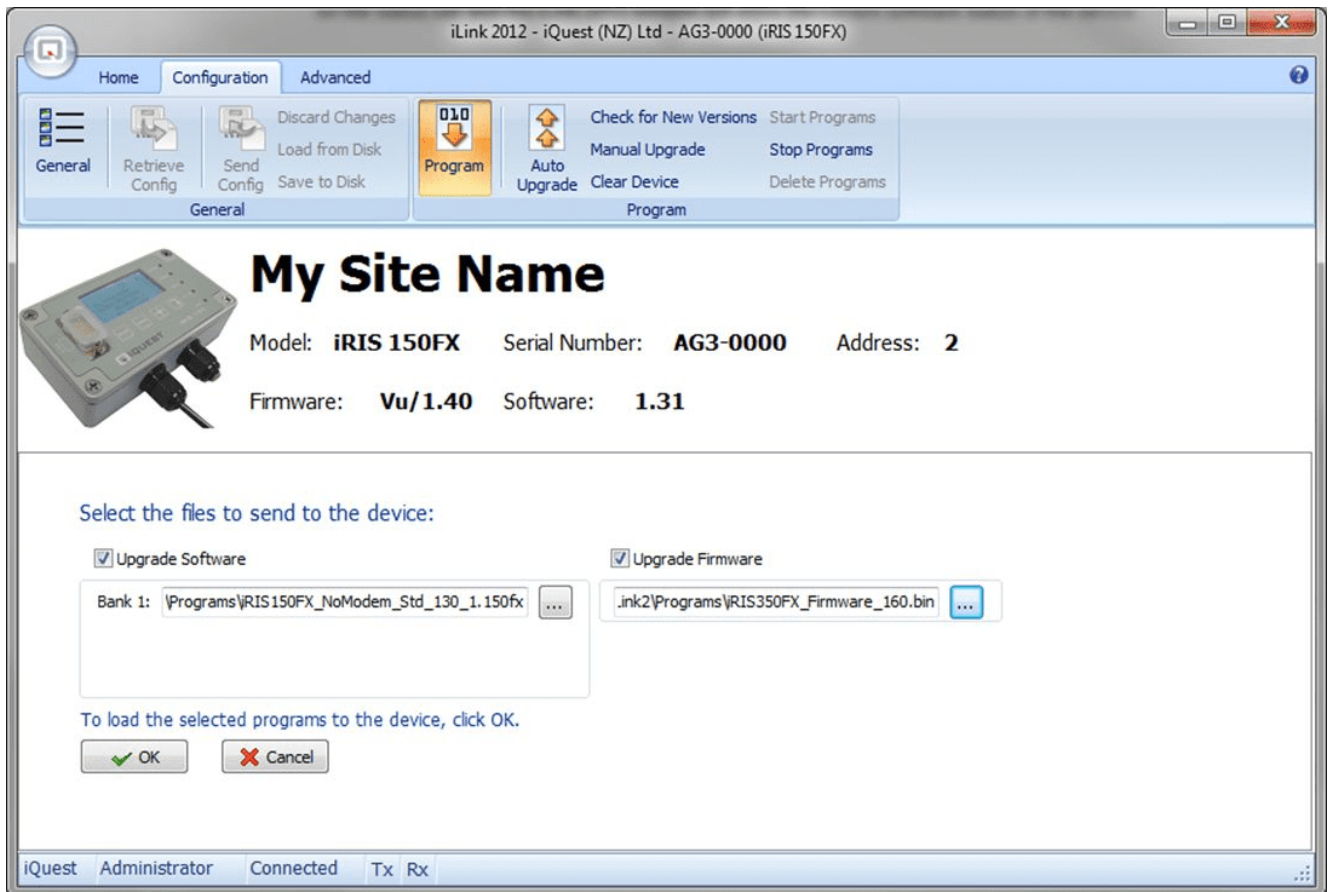


6. Once the process is completed, you can see a message saying "Upgrade completed successfully" on the status bar and the iLink 2012 window will show the current software status of the device.

3.5.4 iRIS Manual Upgrade Procedure

iLink 2012 also allows you to upgrade the software and firmware manually. Please go through the below steps to do a manual upgrade of software and firmware for the iRIS.

1. 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 [File Naming Conventions](#).
2. Connect to the iRIS using iLink 2012.
3. Click on the Manual Upgrade button under the Configuration tab.
4. If upgrading the firmware, first enable the "Upgrade Firmware" checkbox and select the new firmware file using the firmware browse button.
5. Select the appropriate software file using the browse button.



6. Click OK to load the selected programs to the device.
7. Once the process is completed, you can see a message saying "Upgrade completed successfully" on the status bar and the iLink 2012 window will show the current software status of the device.

4 Operation

This chapter contains the following subsections:

- [General Hints](#) ⁴⁵
- [LED Status Indicators](#) ⁴⁵
- [LCD & Keypad](#) ⁴⁶
- [Scan Mode / Scan Rate](#) ⁵¹
- [Analog Input Scaling](#) ⁵²
- [iRIS 150FX Metering Mode](#) ⁵³

4.1 General Hints

If the iRIS will not to be used for some time, remove the internal lithium battery.

Always check the time and date when commissioning the unit. The clock will be invalid if the internal battery has been removed at any time.

Initializing the unit after installation and calibration has been completed is strongly recommended to avoid unwanted and/or invalid samples being logged. See Option 3 in the Terminal Menu (Section [Terminal Menus](#) ³⁷)

4.2 LED Status Indicators

The iRIS has one blue status LED and 4 red status LED's. These are visible through the front panel label and are located to the right of the LCD:

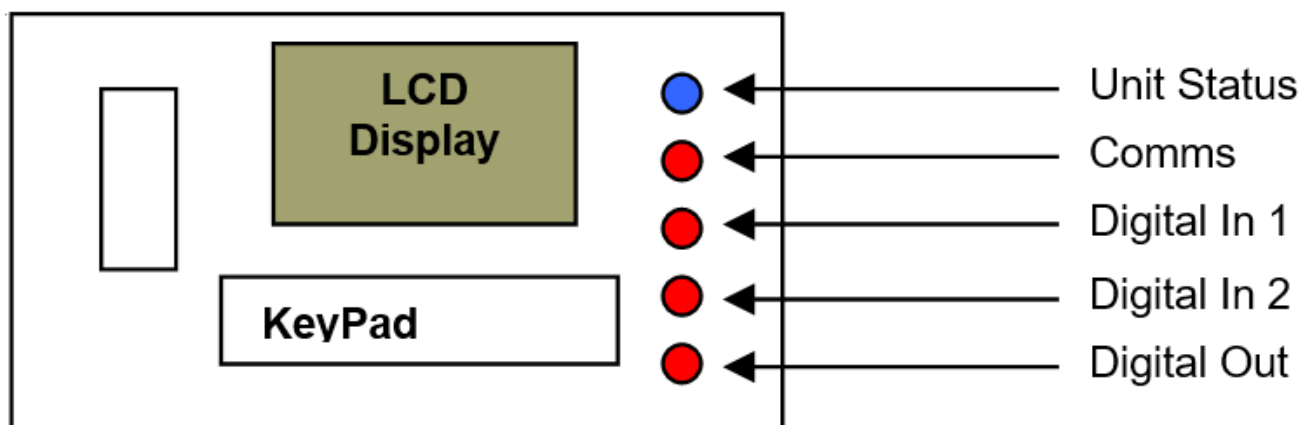


Figure 5 – Status LED Positions

This chapter contains the following subsections:

- [Blue Status LED](#) ⁴⁵
- [Red I/O Status LEDs](#) ⁴⁶
- [Red Comms Status LED](#) ⁴⁶

4.2.1 Blue Status LED

The blue status LED is always enabled, regardless of whether the unit is running on external power or its internal battery. It is used to indicate keypad presses and sampling scans:

- If the LCD is active, the blue LED will flash every time the keypad is pressed.
- If the unit is in Timed scanning mode, the blue LED will flash every time a scan is performed.

4.2.2 Red I/O Status LEDs

The iRIS has 3 red LED indicators that are linked to the digital I/O and can be useful for diagnostic purposes. The LED's are active when the corresponding input or output is active (pulled low).





4.2.3 Red Comms Status LED

The iRIS has a further red LED indicator that provides general communication status. It will flash whenever an RS232 or SDI-12 data packet is transmitted.

Note that the red I/O and comms LED indicators are only active if the unit is running on external power.

4.3 LCD & Keypad

This chapter contains the following subsections:

- [LCD Operation](#)  46
- [Status Icons](#)  47
- [Keypad](#)  47
- [Display Menu Structure](#)  47

4.3.1 LCD Operation

The iRIS LCD is controlled to optimise power consumption. If the display has powered down, the unit is in a lower power mode and can be woken by using 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 60 seconds.

4.3.2 Status Icons

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






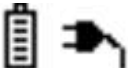
 <p>Indicates current RS232 port mode.</p> <p>Invisible RS232 port in normal mode.</p> <p>Solid with 'R' RS232 Only Telemetry mode</p>	 <p>Indicates active RS232 or IP terminal connection.</p> <p>Invisible No terminal connected</p> <p>Outline Terminal connected</p>
 <p>Indicates the SDI-12 terminal mode is active.</p> <p>Invisible SDI-12 terminal not active</p> <p>Solid SDI-12 terminal active</p>	 <p>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.</p>
 <p>Indicates current access level.</p> <p>Invisible Logged in</p> <p>Outline Logged out</p> <p>Solid Secure (PIN is set to zero)</p>	 <p>Indicates current power source. The battery icon appears when the iRIS is operating from its internal backup battery.</p> <p>A power plug icon appears when on external supply.</p>

Table 6 – LCD Status Icons










4.3.3 Keypad

The keypad is used to navigate through the LCD screens. It is also used to reset the totalisers (not available if the unit is operating in Secure mode).

4.3.4 Display Menu Structure

Scroll through the screens by pressing the + key on the keyboard. The display loops back to the beginning when the keypad is pressed on the last screen. The screens appear in the order in which they are presented here. The – key will scroll backwards through the screens.

This chapter contains the following subsections:

- [Log In/Out](#)  48
- [Title](#)  48
- [System Status](#)  49
- [I/O Summary](#)  49
- [Sensor Status](#)  49
- [Sensor Calibration Screen](#)  49
- [Totals Screens \(DI1 and DI2\)](#)  50
- [Reset Totals Screen](#)  51
- [Call-Back Test Screen](#)  51

4.3.4.1 Log In/Out

The Log-In/Out screen is a special screen that is only available from the Title or Status Screens. It is used to enter a PIN number which then enables access to restricted screens. It is reached by pressing the Alt and Enter keys simultaneously from the Title or System Status screens.

If the user is not logged in, the PIN code can be entered. If the user is already logged in, they will be immediately logged out again. This provides a rapid way of logging out to regain terminal access when the unit is configured for telemetry. See Section [Telemetered Mode](#) for details on telemetered mode.

<pre>LOG IN Pin No. 0000</pre>	+/-	Increment / decrement PIN number
	Enter	Multiply PIN number by 10 or accept PIN number as displayed. Moves back to Title 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. Successful login will also remove the padlock icon from the top of the display.

4.3.4.2 Title

Metering Software variant

The default “home” screen in the metering software variant shows the flow rate and running totaliser for each enabled digital input.

Flow 1:	6.7 l/s
Tote 1:	165448 m3
Flow 2:	0.0 l/s
Tote 2:	5288 m3

Standard Software

The first screen to be displayed is the Title screen in the standard software. This basic screen shows the unit name, serial number, comms address as well as the current time and date.

Demo
iRIS150FX AG3-0001
Adr:1
08:37:46
01 Feb 2014



This screen appears as a second screen in the metering version.

4.3.4.3 System Status

The System Status screen shows the unit's firmware (F) and software (S) versions, the supply voltage and temperature and finally, the current start of data (SOD) and end of data (EOD) pointer values.

The EOD pointer value can range from 0 to 1048575. It will always be zero immediately following unit initialization.

```
Vers: F1.10/S1.20
Supply:      13.8 V
Temp:       22.5 °C
S:0         E:36
```

4.3.4.4 I/O Summary

The I/O Summary screen shows the immediate state of the digital and analogue I/O (inputs/out). The information shown is the voltage being measured at the AI1 and AI2 terminals (in mV) as well as the current status of the digital inputs and output (0 = OFF, 1 = ON). This screen is useful for confirming the electrical connections to the unit when installing or checking it. This screen also shows a diagnostic state value for the SDI-12 interface.

```
AI1:      1754 mV
AI2:       682 mV
DI1: 0    DI2: 1
DO:  0    SDI: 0
```

4.3.4.5 Sensor Status

The sensors that are enabled are presented in order, one screen at a time. The screen is the same for each sensor and provides an overview of the sensor's status. Disabled sensors are not shown.

Line 1 indicates sensor ID, data source and its composite status including:

‘.’ If the sensor is enabled

‘.’ If the sensor and alarm(s) are enabled

“*” If the 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.

```
2:  Flow Rate
Input:      1906
Scaled:     11.07
Logged     1262
```

4.3.4.6 Sensor Calibration Screen

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.



Note: The user must be logged in first. The calibration screen is then accessed by pressing the Enter from the desired sensor's status screen.

- 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.

```
SENSOR CALIB
Scaled: 1.234
Offset: 0.000
Final: 1.234
```

+/-

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.

Multiply PIN number by 10 or accept PIN number as displayed.
Moves back to Title screen

Enter only

Multiply the target value by factor of 10

Alt Enter

Move to the Calibration Acceptance screen

Either - or +
key held
down, then
Enter

Clears the value back to 0.0

Sensor Calibration Acceptance Screen

The Sensor Calibration Acceptance screen is used to accept or decline the sensor calibration. If Yes is accepted by pressing the Enter key, the interim offset entered in the calibration screen previously is stored in the sensor's offset location and overwrites the previous value.

```
ACCEPT CALIB?
> Enter = Yes
Other key = No
```

+/-

Move down / up through available options

Enter

Accept current selection

4.3.4.7 Totals Screens (DI1 and DI2)

There are two Totals screens which show the running totals for the digital inputs, DI1 and DI2 if the input is acting as a source for a sensor.

The values presented represent yesterday's total, the total so far today and the grand running total since the totalisers were last reset.

```
TOTALS (DI1)
Y' day 55.6
Day 17.8
Run 5432.4
```

```
TOTALS (DI2)
Y' day 134.7
Day 26.4
Run 11276.3
```

4.3.4.8 Reset Totals Screen

Note: This screen is only available if there is an authorised user logged in.

The Total Reset screen is used to reset the daily and running totals for both inputs. Press the Alt key for at least 3 seconds to reset the daily and running totals for both DI1 and DI2.

```
RESET TOTALS
Press Alt key for 3
seconds to reset all
totals.
```

A message indicating that the reset has occurred will then be displayed. Pressing the + key will resume the LCD screen sequence.

```
RESET TOTALS
All totalisers have
been reset to zero!
```

4.3.4.9 Call-Back Test Screen

Note: This screen is only available if there is an authorised user logged in and the unit is configured for Telemetry mode.

The Call-back Test screen can be used to initiate a call-back to the designated telemetry base station (usually HydroTel). Pressing the Alt key will initiate the test call. The envelope icon will appear while the call-back test is waiting for an acknowledgement from the base station.

If a successful acknowledgement is received, the icon will disappear. If the call is not acknowledged, the iRIS will repeat the call back every minute. The number of call attempts is displayed on the bottom line of the display. There is a maximum of ten call attempts possible.

```
CALL-BACK TEST
Press Alt key to
initiate test call.
Attempts: 0
```

4.4 Scan Mode / Scan Rate

To optimise the battery consumption when operating from the internal battery, the iRIS has a configurable “scan” option that is changed via Power Settings in the General Config Menu. See Section [Power](#) 27. The scan option has four modes:

This chapter contains the following subsections:

- [Continuous Mode](#) 52
- [Event Mode](#) 52
- [Timed Mode](#) 52
- [Telemetered Mode](#) 52

4.4.1 Continuous Mode

In this mode, the iRIS will process its program continuously. This mode must be used if the logger is attached to instruments that require rapid and continuous measurements such as wind monitoring or special serial devices.

4.4.2 Event Mode

In this mode, the iRIS will process its internal program only on an event, either a digital input activation and/or when a timed event log is due to be stored. This is the lowest power mode and is intended for applications where the logger is powered from only its internal battery (D-size battery variant). Typical installations are rain gauges and pulse type flow meters. Pulses on the digital input(s) are captured and processed on an event basis. If a sensor is set to timed event mode, pulses are accumulated and stored at the predetermined time - otherwise they are logged immediately.

4.4.3 Timed Mode

In this mode, the iRIS will only scan its program once at the programmed rate. This is a lower power mode than continuous and will typically be used for low power analogue measurements. A typical installation is a river level site. Pulses on the digital input(s) are captured and processed on an event basis. If a sensor is set to timed event mode, the pulses are accumulated and stored at the predetermined time.

Note: The log rate for each enabled sensor must be the same as, or an exact multiple of the scan rate. For example, if the iRIS has two analogue sensors attached, one configured to log every 5 minutes and the other every 15 minutes; the scan rate should be set to 1 or 5 minutes. If however, the scan rate was incorrectly set, say to 15 minutes, two out of every three logs of the five-minute sensor would be missed. If it was set, say to 2 minutes, logging would only occur at multiples of two minutes, so both sensors would fail to log certain samples, with times such as xx:05, xx:15, xx:25 and so on missed.

4.4.4 Telemetered Mode

This mode is identical to continuous mode, except that the RS232 port is maintained in a permanently on state. Even though the logger mode may be set to "Telemetered", whether or not it is actually "active" is dependent on certain criteria.

Telemetry mode is active when no user is logged in and there has not been a key pressed or terminal action for at least 10 minutes (600 seconds). I.e. The device assumes that no one is still on site. It is also active when a user is logged in as this enables a communication call-back test to be initiated. It is inactive when a key has been pressed and terminal activity is occurring. To enable terminal use, the user will need to log out. See Section [Log In/Out](#) ⁴⁸.

4.5 Analog Input Scaling

This section explains the recommended procedure to use when scaling an analog input (voltage or current). It makes use of the scaling calculator provided in the iLink 2012 program. However, the calculation can also be done manually using this formula.
 $V = \text{Input V}$, EU = Engineering Units (scaled output e.g. metres).

Multiplier = (Maximum EU - Minimum EU) ÷ (Maximum V - Minimum V)

Offset = Maximum EU - (Multiplier × Maximum V)

4.5.1 Example: A 4 - 20 mA Flow Meter

In this example, we have a flow meter connected to the iRIS Analog Input 1. The meter is configured to provide a 4 - 20 mA signal for a 0 - 100 l/s flow range. The internal current sink resistor in the iRIS is 250 Ω (theoretically giving 5 V at 20 mA). However, there is a small reduction in actual resistance caused by the paralleled internal input impedance of the iRIS input channel to take into account (see Section [Analogue Inputs](#) ¹⁴). 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 meter to zero flow (4mA signal) using its internal simulator function.
3. Note the actual voltage measured by the iRIS (view this on the LCD on the I/O summary screen). See Section [I/O Summary](#) ⁴⁹. The LCD screen example below shows 965 mV for a 0 l/s flow rate.
4. Now increase the meter to full scale (100 l/s, 20 mA) using its internal simulator function. Again, note the measured voltage relating to this input level. This time it is 4891 mV for a 100 l/s rate.

AI1: 965 mV
 AI2: 0 mV
 DI1: 0 DI2: 0
 DO: 0 SDI: 0

AI1: 4891 mV
 AI2: 0 mV
 DI1: 0 DI2: 0
 DO: 0 SDI: 0

5. Using the iLink 2012 Scaling Calculator, enter the minimum and maximum measured voltages and the flows 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.

4.6 iRIS 150FX Metering Mode

When the iRIS 150FX is used in a straightforward metering installation, it is often desirable to view the current flow rate and volume totals on the primary LCD screen for ease of use.

There have been several requests for a customised version of software for the iRIS 150FX that provides just such a display for the user. Also the calculation of either flow rate or volume total from a single sensor has been requested. The iRIS 150FX already supports that feature. However, with the recent release of standard software V1.20, the metering variant is now being addressed. As part of this, the calculation of the derived value will be reviewed. The custom meter software variant will make the following assumptions:

- Flow rate will always be in litres per second.
- Accumulated volume (total) will always be in cubic metres.

Difference between “Pulse” and “Frequency” signal processing

Any pulse signal is of course a flow rate (volume over time). However, because of how the internal processing is done, the iRIS 150FX treats pulse signals differently depending on the nominal pulse rate and the configured sensor source.

“Pulse” is used for slow pulses where each one represents a significant volume, typically 100 or 1000 litres. Therefore the pulses are directly accumulated as an accumulated volume, like rainfall.

“Frequency” is used for fast pulse rates where each pulse typically represents one litre or less and at the once-per-second processing rate of the iRIS 150FX is better managed as a frequency and therefore deemed a flow rate.

There are three specific installation types that the iRIS 150FX metering software variant will support:

1. The meter provides only a slow pulse type signal as an accumulated volume

In this case, the flow rate is calculated from the volume pulses. Because the rate at which pulses are received can vary, the response and accuracy of the calculated flow rate may depend on various circumstances.

The meter’s pulse output must be connected to digital input 1 and sensor 1 configured as a “pulse” source and the multiplier defined to give a total in cubic metres.

Actual accumulated volume: Array id 1

Calculated flow rate: Array id 81

2. The meter provides only a flow rate in the form of an analogue, frequency or other signal

The flow rate can be derived from any source – typically analogue (4 - 20 mA) or digital frequency signal, but also could be from an intelligent sensor type such as SDI-12. The only constraint is the flow rate must be scaled to litres per second. The accumulated volume is derived by integrating the flow rate signal to an accumulating register. The difference in this at each logging interval is stored as the derived volume value.

Actual flow rate: Array id 1

Calculated accumulated volume: Array id 81

3. The meter provides both a pulse and a flow rate signal

This type of installation provides the best quality data, but it involves a more sophisticated flow meter. The installation can be wired to suit as long as sensor 1 is the accumulated volume in cubic metres and sensor 2 is flow rate in litres per second. There are no derived values calculated in this installation.

Actual accumulated volume: Array id 1

Actual flow rate: Array id 2

Calculated flow rate algorithm

Option 1

This is the way the iRIS 150FX currently works. The total number of cubic metres accumulated within the logging period is divided by the number of seconds in that the logging period. This derives reasonably accurate flow rate over the logging period, however it is only calculated at the time of logging and therefore does not vary throughout the logging period.

Option 2

This would measure the time between pulses and derive a basic flow rate. Depending on how quickly the volume pulses are received will determine the rate at which the flow rate is calculated. Pulses received rapidly will provide a fast update, but is likely to lead to poor accuracy especially if there are only a few seconds between each one. The other disadvantage of this method is that should the pulses cease the flow rate calculation will not occur in the last known flow rate will remain. This may require some sort of maximum time limit between pulses to determine when the pulse rate has in fact ceased.

Option 3

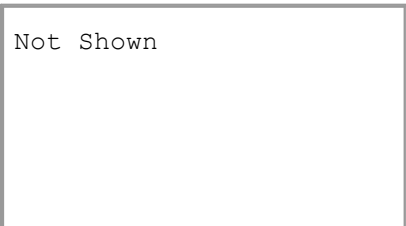
This proposal is a hybrid between the two previous options. In this case the number of pulses and the accrued time are used to calculate the flow rate. This calculation is refreshed every time a pulse is received and is the number of pulses accumulated over the elapsed time. The accuracy will increase as each pulse is received, finalising at the end of the period with the actual value, which is then logged.

During the logging period the flow rate will give, in most circumstances a reasonably accurate and useful value that is responding at least as fast as the pulses are received. This also avoids the problem where the flow rate does not become calculated as zero when the pulses in fact stop. A slight disadvantage is that the displayed flow rate from the start of the logging period until the receipt of the first pulse will be zero. The LCD display could indicate the rate is being calculated to avoid confusion.

LCD Screens

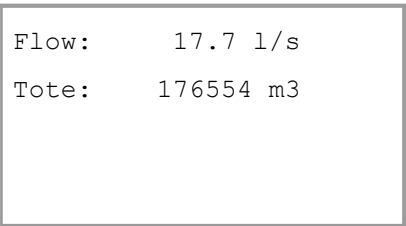
There are two options for the title LCD screen. These are shown below with the standard one for comparison.

Title (Home)



Not Shown

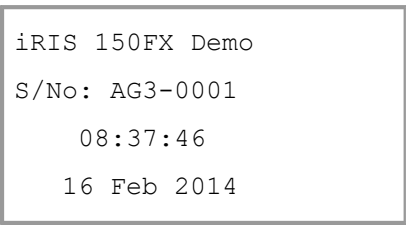
Standard



Flow: 17.7 l/s
Tote: 176554 m3

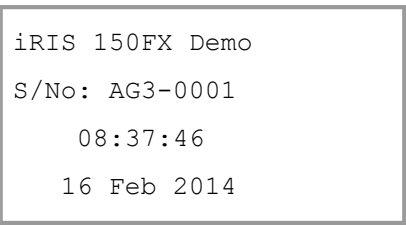
Metering

System Status 1



iRIS 150FX Demo
S/No: AG3-0001
08:37:46
16 Feb 2014

Standard



iRIS 150FX Demo
S/No: AG3-0001
08:37:46
16 Feb 2014

Metering

5 Repair

KISTERS precision instruments and data loggers are produced in quality-controlled processes. All KISTERS production and assembly sites in Australia, New Zealand and Europe are ISO 90001 certified. All equipment is factory tested and/or factory calibrated before it is shipped to the client. This ensures that KISTERS products perform to their fullest capacity when delivered.

Despite KISTERS most rigorous quality assurance (QA), malfunction may occur within or outside of the warranty period. In rare cases, a product may not be delivered in accordance with your order.

In such cases KISTERS' return and repair policy applies. For you as a customer, this means the following:

- Contact KISTERS using the Repair Request Form and the Declaration of Contamination made available online:

Region (Language)	Download Link
Asia-Pacific (English)	Repair Request Form (APAC) Declaration of Contamination (APAC)
Europe, the Middle East and Africa (English)	Repair Request Form (EMEA) Declaration of Contamination (EMEA)
Germany (German)	Repair Request Form (DE) Declaration of Contamination (DE)

In response you will receive a reference number that must be referenced on all further correspondence and on the freight documents accompanying your return shipment.

- Please provide as much information and/or clear instructions within the return paperwork. This will assist our test engineers with their diagnosis.
- Please do not ship the goods prior to obtaining the reference number. KISTERS will not reject any equipment that arrives without reference number; however, it may take us longer to process.

Custom requirements for items sent to KISTERS for warranty or non-warranty repairs: Check with your national customs/tax authorities for details, processes and paperwork regarding tax exempt return of products. Typically, special custom tariff codes are available (such as HS Code = 9802.00) that verify the item is being returned for repair and has no commercial value. Please note that the customs invoice / dispatch documents should also clearly state: "Goods being returned to manufacturer for repair – No Commercial value". It is mandatory to have any returned goods accompanied by a commercial invoice on headed paper. KISTERS reserves the right to charge the customer for time spent rectifying incorrect customs documents.

Note: Please ensure that your goods are packed carefully and securely. Damage that occurs during transit is not covered by our warranty and may be chargeable.

6 Technical Data

Size (W × H × D)	115 mm × 65 mm × 56 mm (4.5 in × 2.6 in × 2.2 in)
Mass	iRIS 150FXC (connector) 420 g (14.8 oz) iRIS 150FXG (glands) 410 g (14.5 oz)
Power Supply	External DC supply: Range 5 - 15 V. Reverse polarity / over voltage protected
Internal Backup Lithium Battery	Standard AA size 3.6 V, 2400 mA/hr or alternatively a D size 19000 mA/hr for standalone use
Communications	Non-isolated DTE RS232 at 1200 bps or 115200 bps (default 115200 bps) SDI-12 instrumentation port
Data Storage	8 MB flash memory (top 64 KB is reserved for firmware / software upgrade files). Total storage: 1,040,384 samples
Environmental	Enclosure: IP65 Operating: -10 °C - +70 °C Storage: -20 °C - +85 °C

7 Obligations of the Operator and Disposal

This chapter contains the following subsections:

- [Obligations of the Operator](#)  58
- [Dismantling / Disposal](#)  58

7.1 Obligations of the Operator

European Union

In the Single European Market it is the responsibility of the operator to ensure that the following legal regulations are observed and complied with: national implementation of the framework directive (89/391/EEC) and the associated individual directives, in particular 2009/104/EC, on minimum safety and health requirements for the use of work equipment by employees at work.

Worldwide

Regulations: If and where required, operating licences must be obtained by the operator. In addition, national or regional environmental protection requirements must be complied with, regardless of local legal provisions regarding the following topics:

- Occupational safety
- Product disposal

Connections: Local regulations for electrical installation and connections must be observed.

7.2 Dismantling / Disposal

When disposing of the units and their accessories, the applicable local regulations regarding environment, disposal and occupational safety must be observed.

Before dismantling

- Electrical Devices:
 - Switch off the units.
 - Disconnect electrical appliances from the power supply, regardless of whether the appliances are connected to the mains or to another power source.
- Mechanical devices:
 - Fix all loose components. Prevent the device from moving independently or unintentionally.
 - Loosen mechanical fastenings: Please note that appliances can be heavy and that loosening the fastenings may cause them to become mechanically unstable.

Disposal

Operators of old appliances must recycle them separately from unsorted municipal waste. This applies in particular to electrical waste and old electronic equipment.

Electrical waste and electronic equipment must not be disposed of as household waste!

Instead, these old appliances must be collected separately and disposed of via the local collection and return systems.

Integrated or provided batteries and accumulators must be separated from the appliances and disposed of at the designated


collection point. At the end of its service life, the lithium-ion battery must be disposed of according to legal provisions.

EU WEEE Directive

As players in the environmental market, KISTERS AG is committed to supporting efforts to avoid and recycle waste. Please consider:

- Avoidance before recycling!
- Recycling before disposal!



This symbol  indicates that the scrapping of the unit must be carried out in accordance with Directive 2012/19/EU. Please observe the local implementation of the directive and any accompanying or supplementary laws and regulations.

8 Appendices

This chapter contains the following subsections:

- [Declaration of Conformity](#)  61
- [SDI-12](#)  62

8.1 Declaration of Conformity

We,
of

HyQuest Solutions (NZ) Ltd
Waikato Innovation Park
Ruakura Road, Hamilton 3214
New Zealand
Ph: +64 7 8570810



in accordance with the following Directives:

2004/108/EC The Electromagnetic Compatibility Directive



Standards met:

BS EN 55022:2010: Incorporating Corrigendum No. 1 and Amendments Nos. 1 & 2

Information Technology Equipment –
Radio Disturbance Characteristics –
Limits and Methods of Measurement

BS EN 55024:2010: Incorporating Amendments Nos. 1 & 2

Information Technology Equipment –
Immunity Characteristics –
Limits and Methods of Measurement

FCC Code of Federal Regulations 47: Telecommunication

Part 15 – Radio Frequency Devices

Subpart A – General

Subpart B – Unintentional Radiators

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced standards and all products supplied under this Declaration will be identical to the sample tested.

Signed:

Name: **David Richards**
Position: **Managing Director**
Place: **Hamilton**
Date: **20/09/2012**



8.2 SDI-12

This chapter contains the following subsections:

- [What is SDI-12?](#)
- [Advantages of SDI-12](#)
- [SDI-12 Electrical Interface](#)

8.2.1 What is SDI-12?

SDI-12 stands for **S**erial **D**igital **I**nterface at **1200** 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.

8.2.2 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.

8.2.3 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 $\pm 10\%$ of the value. The SDI-12 bus is capable of having at least 10 sensors connected to it.

8.2.3.1 Serial Data Line

The data line is a bi-directional, three-state, data transfer line. The table below 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 7 – 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.

8.2.3.2 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.
















8.2.3.3 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.

Note: This information is taken from:

*SDI-12 Serial-Digital Interface Standard for Microprocessor-Based Sensors,
Version 1.3 – September 17, 2002
Prepared By
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