



HYDROSPIDER2

USER MANUAL

v1.25

7 November 2019

Ultra low power telemetry, logging, and alarm system

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WARNING

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Preface

This user manual covers the Halytech hydroSpider in detail.

This document is ordered in the recommended sequence for configuring a hydroSpider.

Each section is ordered with the most commonly used features listed first. More advanced set-up options are moved into separate "Advanced" sections as these are often not required for the majority of users.

Finally the Appendix contains the majority of the reference information such as complete lists of SMS commands and available report formats etc.

Revision History

Document Version	Release Date	Comments
V1.00	22/06/2015	Developed from hydroSpider Mk1
V1.01	04/03/2016	Updated to v1.17 firmware
V1.02	18/04/2016	Updated to include Super Channels
V1.03	21/11/2016	Updated to include DNP3
V1.04	13/01/2017	Updated to v1.29 firmware Added remote access appendix
V1.05	16/01/2017	Added HTTP POST reports
V1.06	23/01/2017	Updated SMS commands
V1.07	07/03/2017	Added DNP3 advanced settings
V1.08	16/03/2017	Updated alarm settings
V1.09	12/05/2017	Added DNP3 file transfer and fast reporting
V1.10	23/06/2017	Added SMTP port numbers Added custom report format 1 Added switch state input type
V 1.11	07/08/2017	Updated for v1.34 firmware
V 1.12	15/08/2017	Updated for v1.35 firmware
V 1.13	19/09/2017	Updated for v1.36 firmware, including maths super channels
V 1.14	24/11/2017	Added serial protocol 1
V 1.15	30/11/2017	Added log positive differences only
V 1.16	19/12/2017	Added RIP HTTP report format Updated remote access
V 1.17	05/03/2018	Added FL900 interface
V 1.18	15/08/2018	v1.49 firmware
V 1.19	21/08/2018	Added remote SMS control of other devices
V 1.20	19/09/2018	V1.51 firmware
V 1.21	08/10/2018	V1.52 firmware
V 1.22	06/11/2018	Added integration and evapotranspiration
V 1.23	12/06/2019	Added periodic alarms
V 1.24	24/07/2019	V1.64 firmware (logging changes)
V 1.25	07/11/2019	Added SWL and parameter channels and LCD modify channel offset

1 Introduction

The Halytech hydroSpider2 is an integrated monitoring, control, and alarm system designed for remote, low power, and battery-powered applications. It can monitor and log a variety of inputs, generate alarms, switch power to sensors, and automatically send reports. It is a complete system – setting up and interrogating a hydroSpider is a simple matter of viewing pages with any standard web browser – no additional software is required.

1.1 Typical Applications

The hydroSpider is a flexible general purpose device that can be configured to suit a wide variety of applications. Some commonly encountered applications include:

- Environmental Monitoring
- Automatic Meter Reading
- Traffic Monitoring
- Waste Management
- Irrigation and agriculture
- Air conditioning
- Process Control

1.2 System Overview

The hydroSpider device is made up of input channels, controls, in-built data storage, an in-built 3G modem, and a battery charging circuit.

The basic hydroSpider system is capable of:

- Monitoring up to 8 inputs. These can be any combination of:
 - up to 4 user inputs,
 - up to 4 system inputs (Battery Voltage, Charger Voltage, System Temperature and Moisture Detector)
- Generating 16 alarms including sending alerts via SMS messages, emails, and tweets
- Switching power out to external devices
- Logging input, control, alarm, and system activity
- Sending automatic reports via email, FTP and HTTP
- Downloading software updates and setup changes via FTP
- Charging a 12V SLA rechargeable battery from a DC or solar source

1.3 Web Interface

All hydroSpider2 units contain a built-in web interface. This eliminates the need for any software to be installed on the PC.

The web interface allows users to access the hydroSpider2 using any web browser, just as they would if they were accessing a website on the internet (but no internet connection or dialling is required).

All actions can be performed using the web interface, including:

- Setting up a hydroSpider
- Viewing current sensor readings
- Downloading logged data
- Controlling outputs
- Viewing and resetting alarms
- Performing software upgrades

The hydroSpider2's web interface has been tested with the following browsers:

- Internet Explorer 11
- Microsoft Edge
- Google Chrome

Note that the browser will need to have JavaScript enabled for the hydroSpider2's web interface to function correctly.

1.4 Logging

The hydroSpider contains on-board storage which it uses for data logging. This memory is non-volatile, meaning that logged data is not lost in the event of a total power failure.

The hydroSpider can store approximately 340,000 records at a time, after which the oldest records are overwritten with newer data. For most applications, this number of records translates into storing many years' worth of data before overwriting is even necessary.

All records logged by the hydroSpider are date and time stamped with 1-second accuracy.

The hydroSpider logs every action it performs, including:

- Channel readings
- Control changes
- Alarm activation, deactivation, and acknowledgement
- SMS transmissions and receptions
- Email, FTP, and Twitter transmissions
- NTP time synchronisation
- Various system messages

1.5 SMS

The hydroSpider is capable of receiving commands via SMS. These commands can perform various actions including changing settings, requesting reports, retrieving the setup file, and remotely calibrating inputs. For a complete list of available commands, see Appendix D - SMS Commands.

1.6 Enclosure

The hydroSpider comes in a compact IP60 enclosure designed to fit inside a tipping bucket rain gauge:



hydroSpider Enclosure

Note: the hydroSpider's moisture sensor should be used as part of ongoing maintenance to avoid damage due to moisture accumulating within the unit.

Note: to avoid damage to the hydroSpider, it is critical to prevent insect infestation.

1.7 Available Add-ons

There are a number of available software and hardware add-ons which extend the functionality of the hydroSpider. The currently available add-ons are briefly described below:

- **Intelligent Sensors (SDI-12 and RS-485):** This factory add-on allows the hydroSpider to collect data from SDI-12 and Modbus sensors. Modbus sensors are connected over an RS485 link. Both SDI-12 and Modbus sensors can be communicated with simultaneously. The total number of inputs that can be monitored increases from 8 to 16. For more information see Appendix A - SDI-12 / RS-485 **Error! Reference source not found..**
- **FlowShark Triton:** Allows the hydroSpider to collect data from ADS FlowShark Triton units.
- **Live SMS:** Extends the SMS capabilities of the hydroSpider. Features include remote web access, SMS alert escalation, more SMS commands, and the ability to schedule modem power ups to create communication windows.
- **LCD / Keypad:** Gives the hydroSpider a built-in display and keypad. This enables the user to browse through the inputs, reset counters and modify input offsets and see system information on the unit itself.
- **DNP3:** Allows the hydroSpider2 to be monitored by a SCADA system



2 hydroSpider Hardware

2.1 Labels

The hydroSpider enclosure has some useful labels on it:

- **Connector and pin labels** (front of the case): these identify the various connectors and associated pins. See 2.6 - Connectors for information about the available connectors.
- **Serial number label** (top of the case): each hydroSpider has a unique serial number assigned to it, which is useful for identifying the unit.

2.2 Opening the case

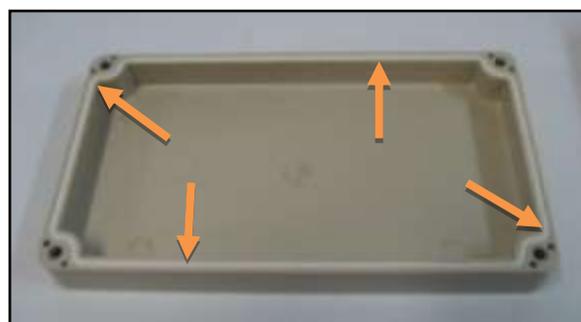
1. Disconnect all external power supplies and sensors from the hydroSpider.
2. Undo the four screws on the lid of the case



3. Lift the lid off the enclosure

2.3 Closing the case

1. Ensure that the seal is still inserted correctly into the groove on lid of the case



Ensure the seal is inserted into the groove

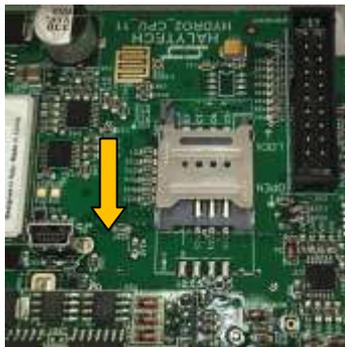
2. Align the lid of the case onto the enclosure
3. Reinsert and tighten the screws in each of the four corners of the lid. It is recommended to tighten the screws go in a diagonal fashion: top left, bottom right, bottom left, top right.

2.4 Installing a SIM Card

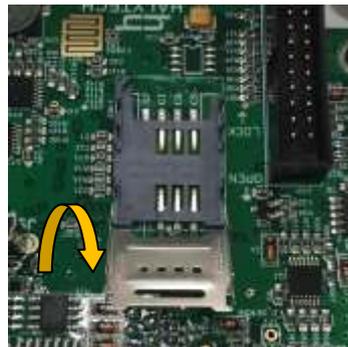
Installing a SIM card into the hydroSpider allows it to send email and FTP reports as well as send and receive SMS messages. Halytech is able to provide you with fully functioning SIM cards, or you can source your own SIM card – just contact your preferred mobile phone carrier and ensure that your chosen SIM card is provisioned with a plan enabling internet access.

To install a SIM card into the hydroSpider:

1. Put the SIM card in a standard mobile phone and disable its PIN (if it has one)
2. Open up the hydroSpider as described in 2.2 - Opening the case.
3. Insert the SIM card:
 - a. Slide the SIM card cover holder to the “OPEN” position
 - b. Lever it upwards on its hinge to open it.
 - c. Lay the SIM card flat onto the base of the SIM socket, observing the proper notch orientation.
 - d. Close the cover
 - e. Slide the cover into the “LOCK” position.



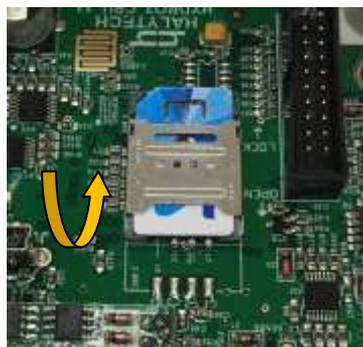
a.



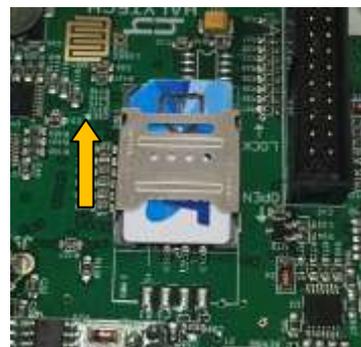
b.



c.



d.



e.

2.5 Internal 9V backup battery

The internal 9V battery serves as backup for the hydroSpider's state information, including the system date and time, counters, alarm state, when the modem should perform retries, and other current system information. Without a 9V battery installed, this information will be lost when power is disconnected from the unit.

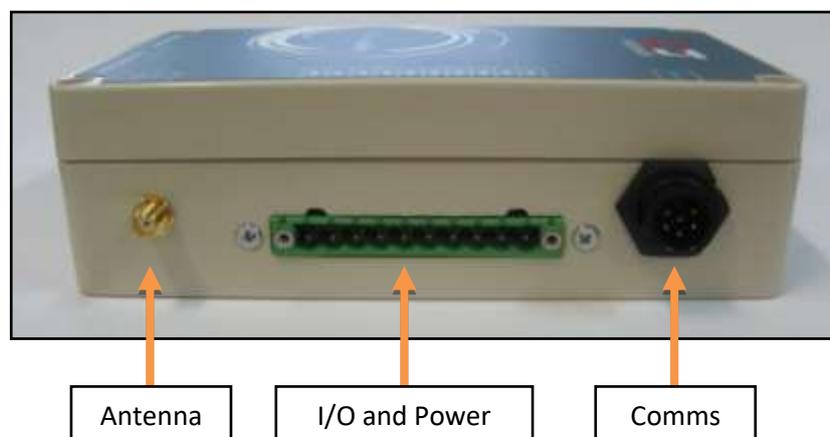
By installing a 9V backup battery, the hydroSpider will enter a special sleep mode if external power is ever disconnected. In this sleep mode, the hydroSpider will not perform its normal operations (logging, alarming, reporting, etc.), but the state information will be saved. Normal operation will then automatically resume when external power returns to 12V.

To insert the backup battery, open up the hydroSpider and connect a standard 9V battery to the battery clip. Insert the battery into the metal holder as shown in the picture below.



2.6 Connectors

The hydroSpider has three connector groups on the right side of the case – Antenna, I/O and Power, and Comms. These are shown in the image below:



2.6.1 I/O and Power Connector

This section describes the pins on the standard hydroSpider's green I/O and Power connector. These pins are labelled on the lid of the hydroSpider.

Label	Name	Function(s)	Comment
GND	GND	Ground	Common for all signals
AIN1	AIN1	Analogue 1 (Voltage 0 - 2.4V or Current 4-20mA)	User selectable
DIN1	DIN1	Switch 1 Counter 1 Quadrature 1a	Active is short to ground
OC	OC OUT	Open Collector Output	Driven by control 2, nominal 10 mA
DIN2	DIN2	Switch 2 Counter 2 Quadrature 1b	Active is short to ground
AIN2	AIN2	Analogue 2 (Voltage 0 - 2.4V or Current 4-20mA)	User selectable
SWP	PWR OUT	Switched Power Out	Driven by control 1, max 1A
BATT	PWR IN	External Power In or Battery	Nominal 12V DC max 7.2Ah battery
CHG	CHARGER IN	Charger Supply In	16V – 24V 2A DC or 12V Solar Panel
GND	GND	Ground	Common for all signals

Note: the two GND pins are equivalent and all inputs and outputs are referenced to this common ground.

Note: hydroSpiders fitted with optional SDI-12 / RS-485 or RS-232 interfaces have different pinouts. Please refer to Appendix A - SDI-12 / RS-485 and Appendix B - RS-232 for information on these changes.

2.6.2 Connecting power

Connect the positive of the selected 12V DC 1A power source to the *BATT* (PWR IN) pin and the negative to a *GND* pin. Take caution to observe the correct polarity to avoid damaging the hydroSpider.

Note that if you wish to use the charger feature of the hydroSpider, then you must use a 12V SLA rechargeable battery of **no more than 7.2Ah capacity**. Otherwise, any 12V battery or 12V DC supply capable of supplying 1A current can be used.

2.6.3 Connecting a charger supply

This charger feature can be used to both power the hydroSpider and to charge a 12V SLA rechargeable battery connected to the *BATT* port.

Note: if the *Charger* port is to be used, then the *BATT* port must either be connected to a 12V SLA rechargeable battery of **no more than 7.2Ah capacity** or be left unconnected. Connecting both the *BATT* and *Charger* ports to power supplies at the same time will cause damage to the hydroSpider's charger circuitry.

Simply connect the positive of a 15V – 24V DC 2A power supply or a 12V solar panel to the *CHG* (CHARGER IN) pin and the negative to a *GND* pin. Take caution to observe the correct polarity to avoid damaging the hydroSpider.

Note that the hydroSpider can be solely powered from the charger supply by not connecting anything to the *BATT* port.

2.6.4 Connecting the antenna

The antenna can be connected to the hydroSpider by simply screwing the antenna's connector into the *ANT* port of the hydroSpider using your fingers. Do not use tools to tighten the connector as this may cause damage.

2.7 Connecting Sensors

Refer to Appendix H – Connecting Sensors for information about how to connect sensors to the hydroSpider.

2.8 Controls

The hydrospider2 provides two controls.

1. "Switched Power Out"
This can be used to power sensors from the external power supply or battery. The hydrospider2 will switch the power to the sensor when required.
2. "Open Collector"
It can be used to control external devices such as automatic samplers and power supplies. When activated, this output will create a connection to GND through a 440 Ohm resistor.

Controls can be used in three ways:

1. By accessing the "Controls" page with a browser and clicking the ON/OFF buttons
2. By configuring alarms to turn controls On/Off when the alarm triggers
3. By configuring the control to be used as a warm-up source for a channel.

3 Keypad / LCD Option

3.1 Introduction

Every hydroSpider has built-in support for a two-line display and a three-key keypad. The keypad and the LCD are used for quick operational checks and basic operations such as resetting counters and setting the current value of an input. Its convenience lies in the fact that using it requires no external equipment such as laptop computers or mobile phones.

Normally, the Keypad / LCD is factory fitted. However, you can order this option and retrofit it yourself at any time. If purchased later, a new Keypad / LCD hydroSpider lid will be supplied. You can simply replace the existing lid and plug the cable into the hydroSpider mother board. The hydroSpider will automatically recognize the new option when next powered up.



3.2 Using the Keypad and Display

The Keypad / LCD is normally turned off and consumes no power. Pressing any of the keys turns the display and its backlight on.

In order to conserve battery power, the display will automatically turn off after two minutes of key press inactivity. The shutdown happens in two stages – firstly the backlight turns off to indicate that the display is about to be switched off, and secondly after approximately another 30 seconds the display will completely turn off.

Initially, the display shows:

**Halytech
hydroSpider2**

Different display screens are accessed by briefly pressing the left and the right arrow keys. Each key press will display a new screen:

1. Current date and time
2. Current value of input channels
(a '*' indicates that the most recently logged value is displayed instead of the current state)
3. Current battery charger voltage and battery voltage
4. Current system temperature
5. Current state of System Moisture Indicator
6. Current LAN IP address and IP Mask
7. Software version

3.2.1 Resetting Counters

The LCD / keypad can be used to reset a counter or event channel to zero.

To reset a Counter or Event channel:

- Press the 'OK' button when the channel is displayed
- Press the left or right arrow key to highlight the "YES" option
- Press 'OK' again to reset the count to zero.

3.2.2 Modifying an Input Channel Offset

The LCD / keypad can be used to set the current value of any input that can be calibrated with an offset. Inputs which can be calibrated in this way include:

- Analogue voltage
- Analogue 4-20 mA
- SWL super channel

To set the current value of an input:

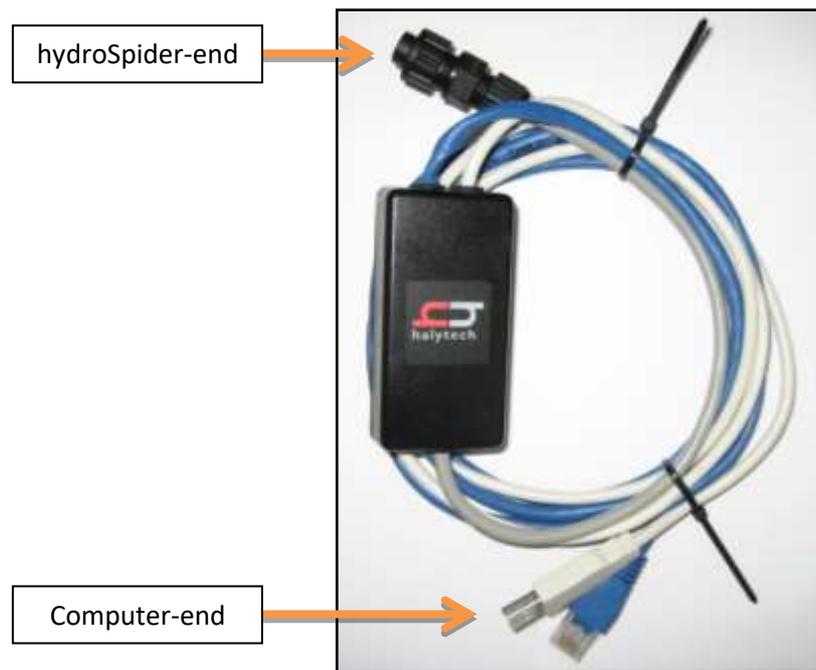
- When the channel is displayed, press and hold the 'OK' button for 3 seconds
- Press the left or right arrow key to highlight the "YES" option
- Press 'OK'
An underline cursor ('_') should appear in the leftmost character position
- Use the arrow keys to move the cursor to a digit which you wish to modify
- Press 'OK' to select the character
The cursor should change to a flashing block, indicating that you can edit that character
- Use the arrow keys to change the character:
 - Numbers can be set to any digit in the range 0 – 9
 - The leftmost position is the sign character, which can be a space (' ') for positive values, or a minus sign ('-') to indicate that the value is negative
 - The '.' character is fixed and cannot be changed
- Press 'OK' when you have finished editing the character
The cursor should change back to an underline
- Repeat the process of using the arrow keys to select to the next digit to modify, press 'OK' to edit it, use the arrow keys to change it, then 'OK' again when finished
- When you have finished updating the value, press and hold 'OK' for 3 seconds
You should see a "SAVE?" prompt, with the modified value above it.
- If you wish to apply your changes, use the arrow keys to highlight the "YES" option.
Otherwise, select "NO".
- Press 'OK'
If you chose to save, the display should update to show the new value and the channel's offset will be automatically updated.

4 Web Interface

This section contains a brief overview of the hydroSpider's web interface by including descriptions and screenshots of important pages. The rest of this manual will reference the pages covered in this chapter, so it is worth reviewing.

4.1 Connecting to the hydroSpider

In order to be able to access the hydroSpider's web interface and configure the unit, you must first connect the hydroSpider to your PC. A Halytech LANlink cable, pictured below, is required to connect the hydroSpider to a PC.

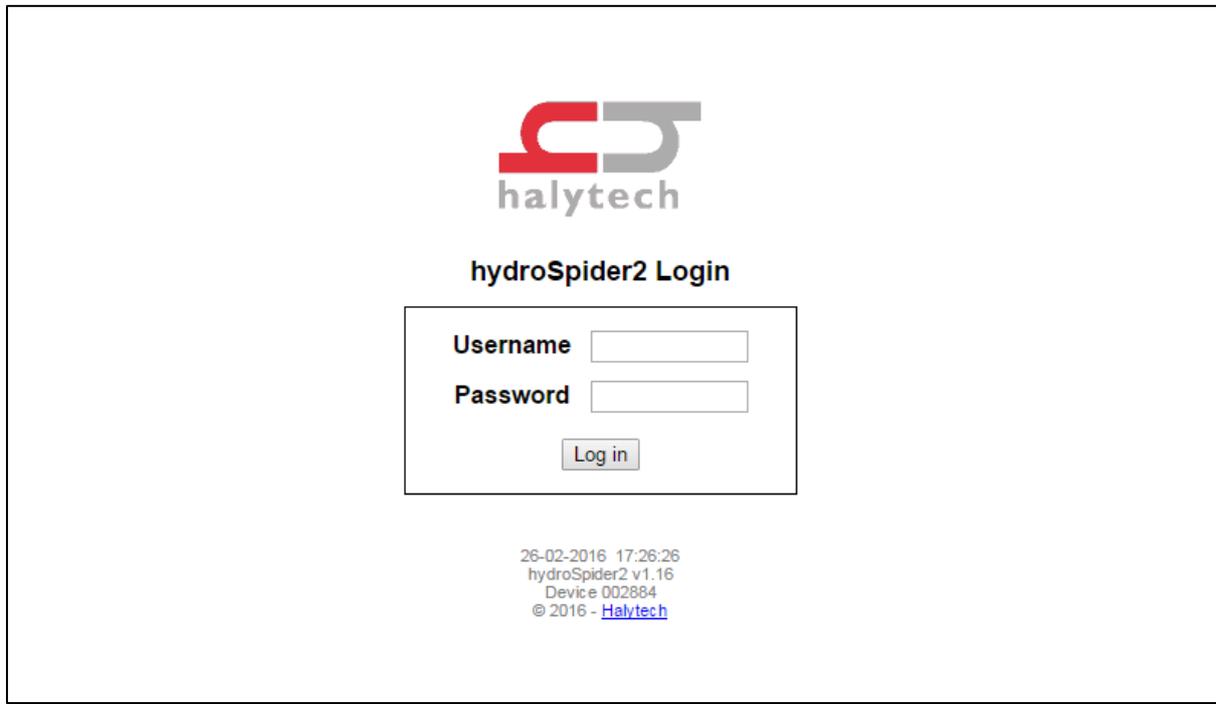


1. Power up the hydroSpider as described in 2.6.2 - Connecting power. The hydroSpider will not communicate with you unless it is powered up.
2. Turn on your computer and disconnect it from all networks, including any wireless networks.
3. Plug the round hydroSpider-end of the LANlink cable into the Comms port of the hydroSpider.
4. Plug the connectors on the Computer-end of the LANlink cable into your computer's LAN and USB ports.
5. Wait 30 seconds for the hydroSpider to power up and register with your computer.
6. Open a browser (eg: Internet Explorer) on your computer and request the following address: <http://192.168.0.177>
7. The hydroSpider Log In page should be displayed.

You have successfully connected to your hydroSpider. Please refer to 4.2 - Logging in for further instructions.

4.2 Logging in

The login screen is the first screen you will see once you have successfully connected to the hydroSpider using your computer. At the bottom of the login page, the hydroSpider displays the current date, time, software version, and serial number. These are useful for quickly identifying the hydroSpider without logging in.




hydroSpider2 Login

Username

Password

26-02-2016 17:26:26
hydroSpider2 v1.16
Device 002884
© 2016 - [Halytech](#)

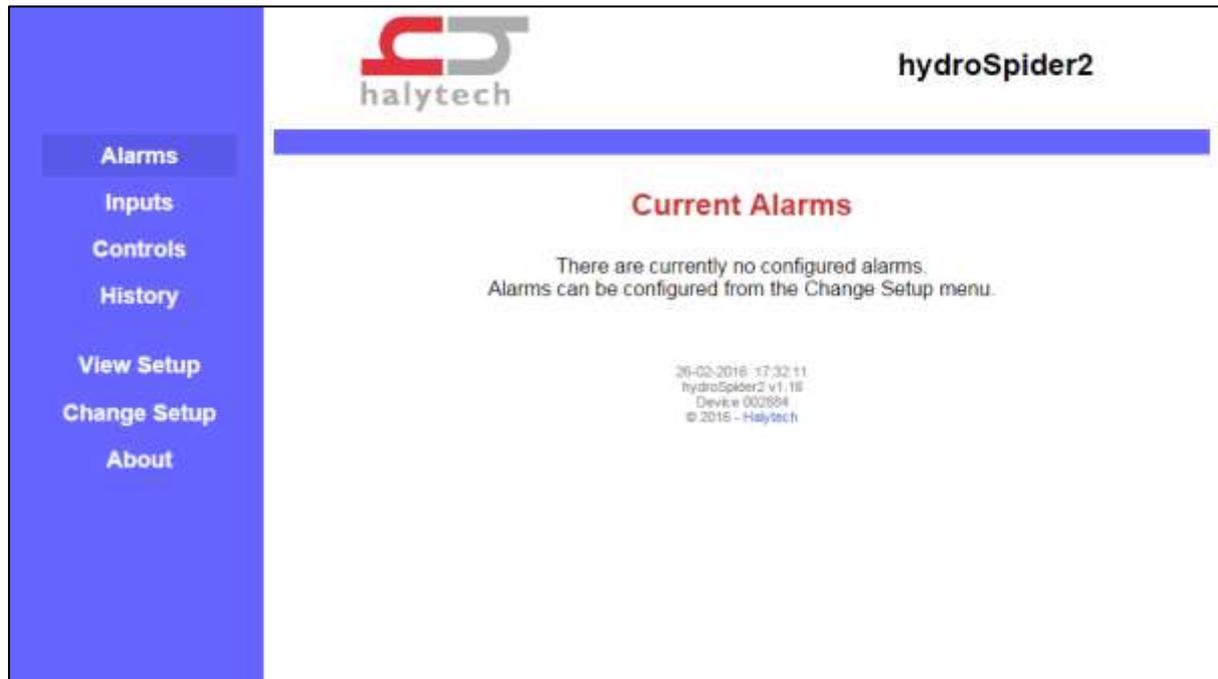
Default username: user
Default password: changeme

To log in, enter the username and password into the corresponding text boxes and click the Log In button. Once you have successfully logged into the unit, you will be presented with the hydroSpider's web interface. If log in fails, you will be redirected back to the Log In screen.

Note: in the event of a forgotten username and password, you will not be able to gain access to the web interface. If this happens, please contact Halytech or one of its agents for assistance.

4.3 Alarms: Status of Current Alarms

The *Current Alarms* page is shown immediately after logging in, and can also be accessed by clicking on the *Alarms* link from the menu down the left hand side of the web interface.



By default, there aren't any alarms configured in the hydroSpider. Once one or more alarms are configured, the Alarms page will show the status of these alarms including whether they are active, inactive, acknowledged, or unacknowledged. Unacknowledged alarms are shown in **red**.

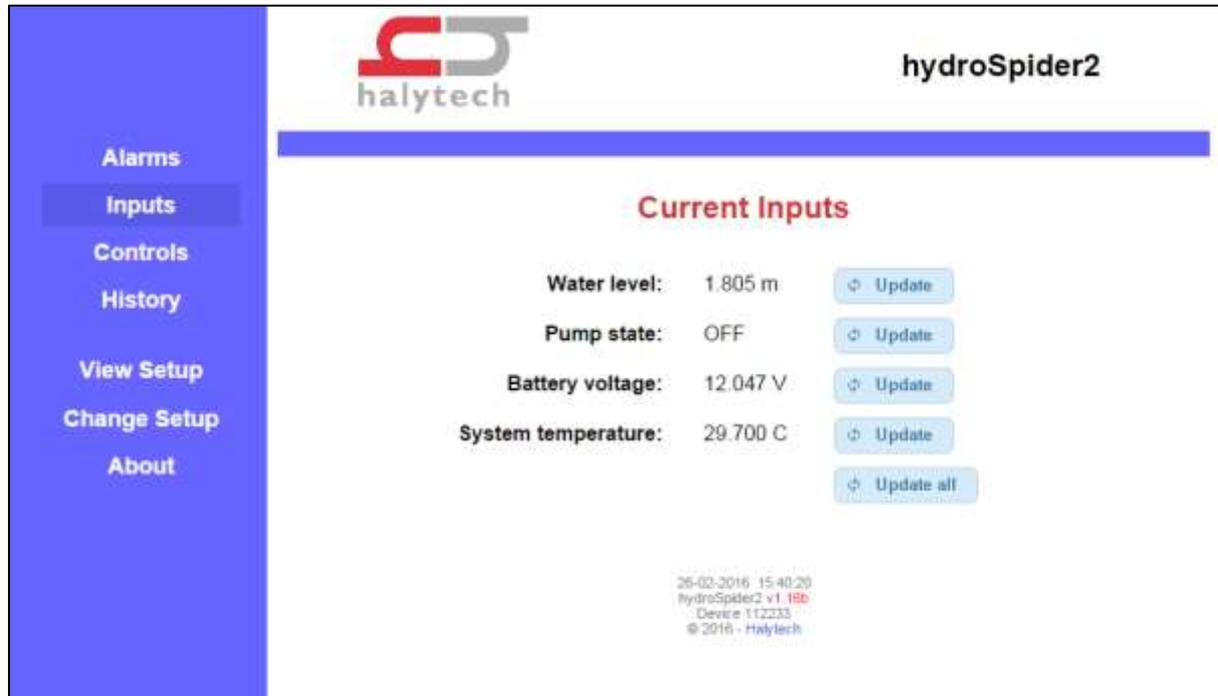
This page also allows you to acknowledge individual alarms by clicking on them, or acknowledging all alarms by clicking on the link at the bottom of the page.

Detailed information on the available alarm codes can be found in Appendix C - Alarm Status Codes.

4.4 Inputs: Current Input Readings

The Inputs page shows the value of all configured inputs. These readings can be updated to retrieve up-to-date readings. Readings can be individually updated by clicking the *Update* button next to the relevant channel, or all updated by clicking the *Update All* button.

To access the *Current Inputs* page, click the *Inputs* link located in the menu on the left hand side of the web interface.



The screenshot displays the hydroSpider2 web interface. On the left is a blue navigation menu with the following items: Alarms, Inputs (highlighted), Controls, History, View Setup, Change Setup, and About. The main content area features the Halytech logo and the text 'hydroSpider2' at the top. Below this is a blue horizontal bar. The central heading is 'Current Inputs'. The data is presented as follows:

Water level:	1.805 m	Update
Pump state:	OFF	Update
Battery voltage:	12.047 V	Update
System temperature:	29.700 C	Update
		Update all

At the bottom right of the main content area, there is a timestamp and version information: 26-02-2016 15:40:20, hydroSpider2 v1.18b, Device: 112233, © 2016 - Halytech.

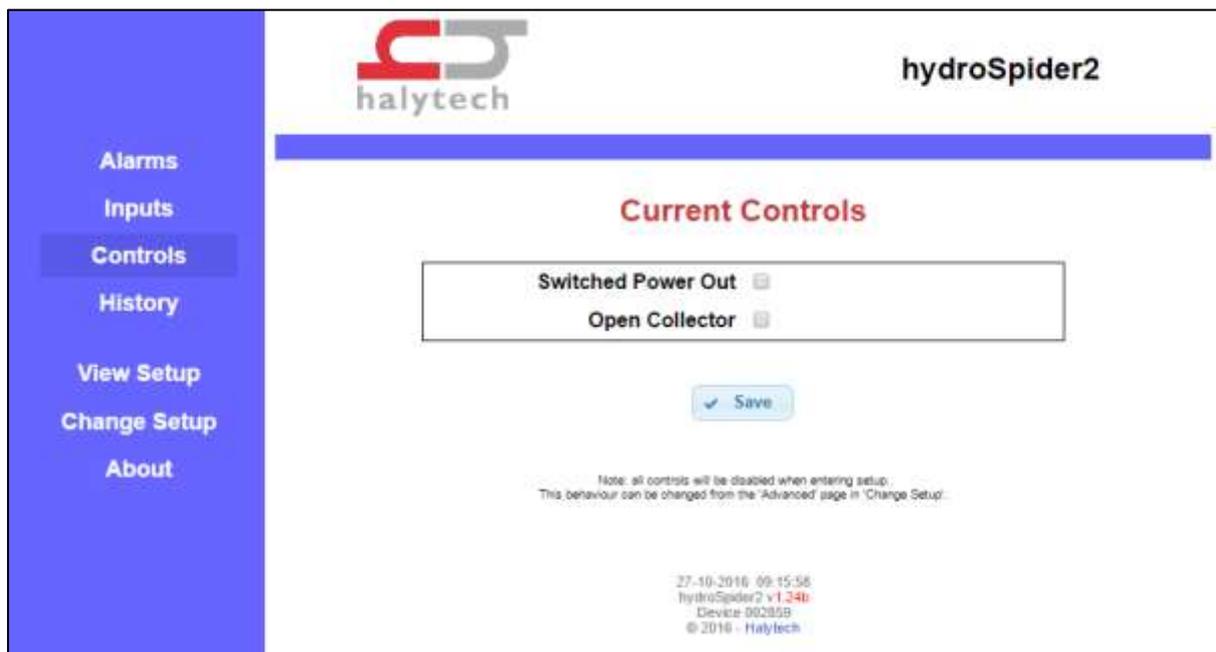
4.5 Controls

The *Current Controls* page shows the state of all controls, and allows you to turn each control on or off.

To access the *Current Controls* page, click the *Controls* link located in the menu on the left hand side of the web interface.

The display shows the state of all Controls at the time the page was displayed

You can change as many outputs at once as you wish by clicking the checkboxes as required and then clicking the "Save" button. The page will be updated to reflect the new Control states.

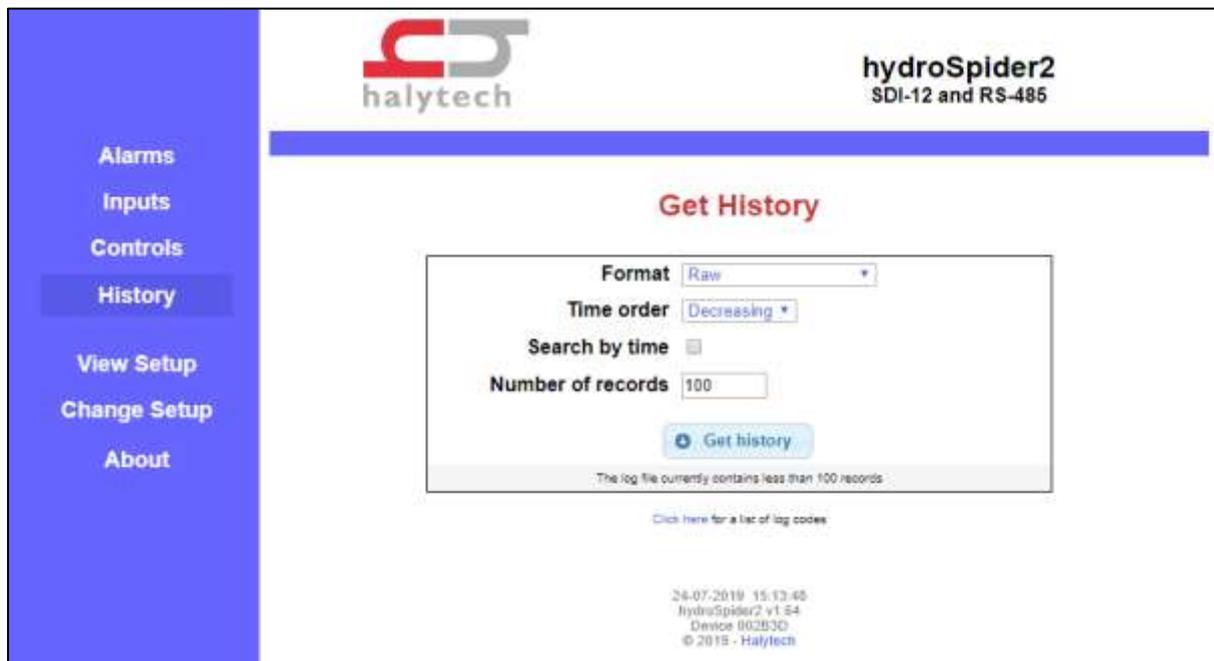


Chapter 5.4 - Control covers controls in more detail.

4.6 History: Download Logged Data

The *Get History* page lets you download logged data from the hydroSpider at any time.

To access the *Get History* page, click the *History* link located in the menu on the left hand side of the web interface.



The Get History options are:

- Format:** The format the log files will be saved in.
 Raw and Diagnostic formats contain all the logged data plus system information such as reception of SMS messages, outcome of alarms, reports etc. The User ID format makes use of the User-defined ID (rather than the Default ID) assigned to each input.
 Filtered format provides data in a simpler form. It contains only logged input data.
 Multi Column format provides data of multiple channels in a single row. It contains only logged input data.
 See Chapter Appendix I - Report Formats for more details
- Time order:** Select increasing to have the records in the log file ordered from oldest to newest; or decreasing to have the records ordered from newest to oldest.
- Search by time:** By default, the most recent records are included in the log.
 If you select "Search by time", you can specify a start date and time, an end date and time, or both ("Range"). Records from the start date/time and/or up to and including the end date/time will be included in the log, allowing you to see what happened after, leading up to, or during a specific time of interest.
- Number of records:** specify the number of records to download.
 If you are searching by time and have specified a date/time range, all records from the start date/time to the end date/time will be downloaded and "number of records" doesn't apply, and is therefore not shown for a date/time range search.

Click the “Get History” button to start the download.

Data is downloaded as a “CSV” file. Download can automatically start Microsoft Excel program on your computer (if installed) to show, edit or store the data.

4.7 View Setup

The View Setup page allows you to review all of the hydroSpider's settings.

To access the *View Setup* page, click the *View Setup* link located in the menu on the left hand side of the web interface.

The screenshot displays the 'View Setup' page of the hydroSpider2 web interface. On the left is a blue sidebar menu with the following items: Alarms, Inputs, Controls, History, View Setup (highlighted), Change Setup, and About. The main content area has a white background with a blue header bar containing the halytech logo and 'hydroSpider2'. Below the header, the title 'View Setup' is centered. A box displays configuration details: Location (short) Location 1, Location (long) (empty), Current date 29-02-2016, Current time 09:58:40, and Time zone +11:00. Below this box is a vertical list of settings: Inputs, Controls, No configured alarms (dropdown), Network, Email, Reports, Time Synchronisation (NTP), Twitter, Automatic Setup Management, Automatic Software Upgrades, Modem and Battery Usage, and Advanced. A 'Save setup to disk' button is at the bottom. A footer at the very bottom shows: 29-02-2016 09:58:40, hydroSpider2 v1.16, Device 002004, © 2016 - Halytech.

The page shows some common information including the hydroSpider's location name, the date and time, and the time zone. There are also a number of links on this page which let you view the rest of the settings, including:

- Input/channel settings
- Settings of all alarms
- Network settings for LAN and mobile internet
- Email setup
- Report settings
- NTP time synchronisation

- Twitter setup
- Automatic update settings
- Modem and Battery usage
- Advanced settings
- Saving the setup file to your computer

4.8 Change Setup

The *Change Setup* link brings you to a page which will allow you to change the hydroSpider's configuration. This page contains a number of links for accessing all of the available settings, saving the setup file, and performing diagnostics.

To access the *Change Setup* page, click the *Change Setup* link located in the menu on the left hand side of the web interface.



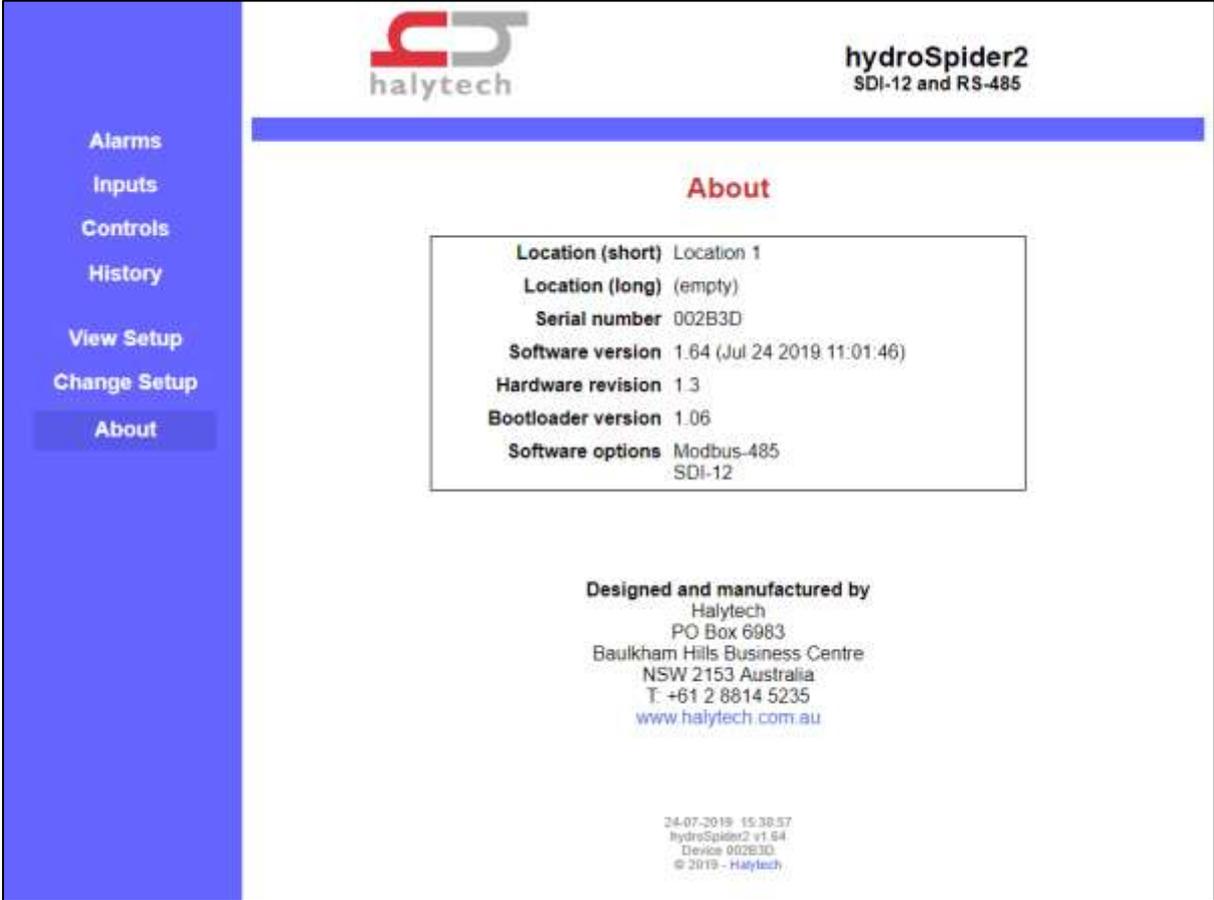
Each of these links is discussed in different sections throughout this document. For example, the Input Setup link is discussed in Chapter 5.5 - Input Channels.

Note that, as indicated by the confirmation message, while in Change Setup, the hydroSpider will not log its usual data. Entering change setup will, by default, also acknowledge all alarms and turn off all controls. Changing this behaviour is discussed in Chapter 5.17 - Advanced Settings.

4.9 About

The *About* page shows you general information about the hydroSpider device, including the location name, hardware revision, software version and build date, boot loader version, serial number, and any installed software options.

To access the *About* page, click the *About* link located in the menu on the left hand side of the web interface.



The screenshot displays the web interface for the hydroSpider2 device. On the left is a blue navigation menu with the following items: Alarms, Inputs, Controls, History, View Setup, Change Setup, and About (highlighted). The main content area features the Halytech logo and the text 'hydroSpider2 SDI-12 and RS-485'. Below this is a blue header bar with the word 'About' in red. A central box contains the following information:

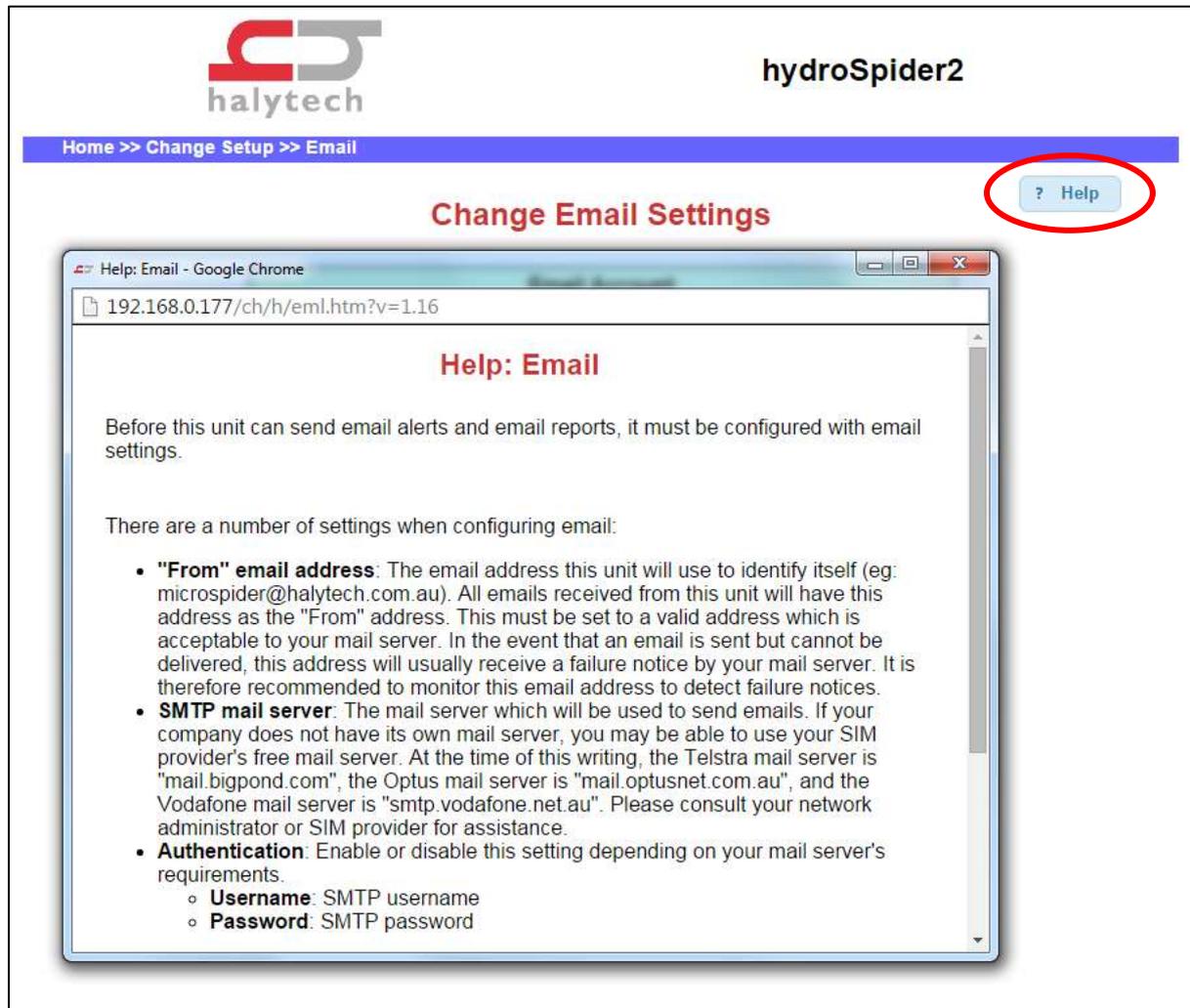
Location (short)	Location 1
Location (long)	(empty)
Serial number	002B3D
Software version	1.64 (Jul 24 2019 11:01:46)
Hardware revision	1.3
Bootloader version	1.06
Software options	Modbus-485 SDI-12

Below the information box, it states: 'Designed and manufactured by Halytech, PO Box 6983, Baulkham Hills Business Centre, NSW 2153 Australia, T: +61 2 8814 5235, www.halytech.com.au'. At the bottom right, there is a footer with the text: '24-07-2019 15:38:57, hydroSpider2 v1.64, Device 002B3D, © 2019 - Halytech'.

4.10 Accessing On-page Help

Many of the hydroSpider's webpages contain on-page help. This is accessed by clicking the *Help* button on the top right of the page. Clicking this button will open the relevant help in a new window.

On-Page help is useful if you are in the field and need a quick refresher of the content covered in this manual. Much of the content contained within this manual is also available in the on-page help.



5 Setting up the hydroSpider

A new hydroSpider is shipped with factory default settings. This chapter and following chapters will guide you through customising these settings. It is recommended to set up the hydroSpider in the following order:

1. Location
2. Date and Time
3. Username and password
4. Control names
5. Input channels
6. Channel calibration
7. Network parameters
8. Email
9. Twitter
10. Alarms
11. Reports
12. Perform modem diagnostics
13. Automatic setup updates
14. Automatic software updates
15. Save a copy of the setup

To begin making changes to the settings, go to the Change Setup page as described in Chapter 4.8 – Change Setup

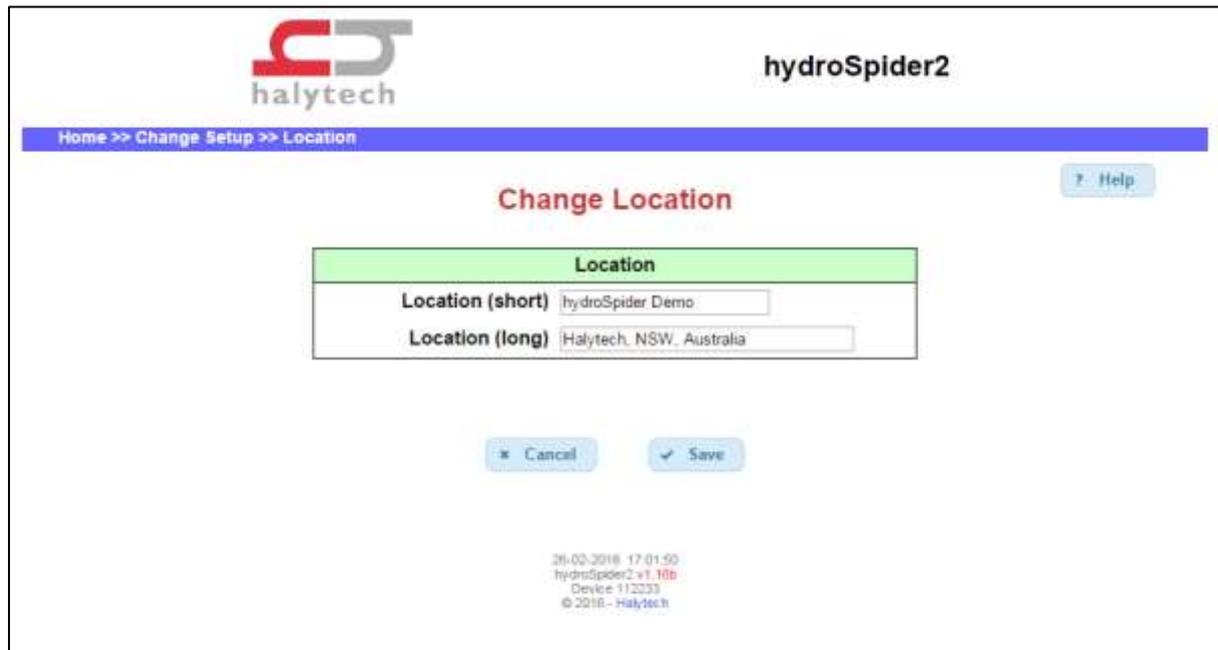
This page gives you links to all the other pages required during the setup process.

5.1 Location

It is important to choose a unique location name for each hydroSpider so that you can easily identify it down the track. The location name is also used by the hydroSpider when sending alarm alerts and reports.

There is also a *long location name*, which is used if additional information is required to describe the location of the hydroSpider.

To set the hydroSpider's location, click the *Location* link on the *Change Setup* page. This will bring you to the Change Location page, shown below:



The screenshot shows the 'Change Location' page in the hydroSpider2 web interface. At the top left is the Halytech logo, and at the top right is the text 'hydroSpider2'. Below the logo is a breadcrumb trail: 'Home >> Change Setup >> Location'. The main heading is 'Change Location' in red, with a 'Help' button to its right. The form contains two input fields: 'Location (short)' with the value 'hydroSpider Demo' and 'Location (long)' with the value 'Halytech, NSW, Australia'. Below the form are 'Cancel' and 'Save' buttons. At the bottom, there is a timestamp '26-02-2016 17:01:50', the version 'hydroSpider2 v1.10b', the device ID 'Device: 112233', and the copyright '© 2016 - Halytech'.

From here, you can enter a location name for this particular hydroSpider. The name can be up to 16 characters long. In the screenshot above, the location name was set to "hydroSpider Demo".

Click the *Save* button to save your changes to the hydroSpider's configuration, or click *Cancel* to return to the *Change Setup* page without saving any of the changes.

5.2 Time and Date

Setting the hydroSpider's time and date will ensure that reports, alarms, and alerts line up with the real-world time.

To set the time and date, click the *Time & Date* link on the *Change Setup* page and simply enter the current date and time into the appropriate fields.

Alternatively, you can synchronise the hydroSpider's time and date by clicking on 'Set from computer' and then clicking 'Save'.

The screenshot displays the 'Change Time and Date Settings' page in the hydroSpider2 interface. The page header includes the Halytech logo and the product name 'hydroSpider2'. A breadcrumb trail shows 'Home >> Change Setup >> Time / Date'. A 'Help' button is located in the top right corner. The main content area is titled 'Change Time and Date Settings' and contains two primary configuration sections:

- Time and Date:** This section allows manual entry of the current date (26/02/2016), current time (17:07:15), and time zone (+11:00). A 'Set from computer' button is provided for automatic synchronization.
- Time Synchronisation (NTP):** This section features an 'Automatic NTP' checkbox (currently unchecked) and an 'NTP server' text box containing '0.au.pool.ntp.org'. A 'Synchronise now' button is available for manual synchronization. A note at the bottom of this section states: 'Note: daylight saving is not supported.'

At the bottom of the page, there are 'Cancel' and 'Save' buttons for finalizing the changes.

5.2.1 Advanced – Network Time Protocol

The hydroSpider has the ability to synchronise its clock to the current time using what is known as NTP (Network Time Protocol). If Automatic NTP is enabled, the hydroSpider's time will be synchronised daily. This ensures that the hydroSpider's time will not slowly drift away from the real time.

Note that the *Synchronise now* button will not work at this point in the setup procedure because the hydroSpider's network parameters have not yet been set up. After they have been set up, you can come back to this page and perform an NTP time synchronisation by clicking this button.

Note that the hydroSpider does not support daylight saving, and so NTP will always update the clock to the non-daylight saving time. If manually adjusting the clock, it should be set to the non-daylight saving time.

5.3 Username and Password

Only authorised users may access a hydroSpider. A correct username and password must be entered in the *Log In* page before any of the hydroSpider's settings can be viewed or changed.

The hydroSpider2 supports three levels of access:

- The **Administrator** account has full control of the hydroSpider2, including viewing and changing its settings.
- The **Service** account is able to view this unit's settings and status, and can perform diagnostic tests, set the time and calibrate inputs.
- The **User** account is only able to view the hydroSpider2's settings and status, but cannot make changes to its settings.

The administrator has a default username of "user" and a password of "changeme".

The service account has a default username of "service" and a password of "changeme".

The user has a default username of "user" and a password of "user".

It is strongly advised that the username and password for all three accounts be changed as soon as possible, to prevent unauthorised access to the hydroSpider2.

To change the username and password of either account, click the *User / Password* link on the *Change Setup* page. This will lead you to the *Change User / Password* page, shown below. You may now enter new usernames and passwords for the administrator, service and user accounts.

The screenshot displays the 'Change User / Password' web interface. At the top, there is a navigation bar with the Halytech logo and the text 'hydroSpider2 SDI-12 and RS-485'. Below the navigation bar, the page title is 'Change User / Password' with a 'Help' button. The main content area is divided into three sections, each with a green header and a white body:

- Administrator account:** Username: user, Password: changeme. Description: The administrator account can be used to change and view setup.
- Service account:** Username: service, Password: changeme. Description: The service account can be used to perform tests and input calibration.
- User account:** Username: user, Password: user. Description: The user account can only be used to view setup.

At the bottom of the form, there are two buttons: 'Cancel' and 'Save'.

Note: in the event of a forgotten username and password, you will not be able to gain access to the hydroSpider's web interface. If this happens, please contact Halytech or one of its agents for assistance.

5.4 Controls

The *Change Controls* page can be accessed from the *Change Setup* page by clicking on the *Controls* link.

The screenshot shows the 'Change Controls' web interface for hydroSpider2. The page has a blue header with the Halytech logo and the text 'hydroSpider2'. Below the header is a breadcrumb trail: 'Home >> Change Setup >> Controls'. The main content area is titled 'Change Controls' and includes a 'Help' button. There are two control configuration sections, each with a green header and a white body. The first section is 'Switched Power Out' and the second is 'Open Collector'. Each section has a 'Custom name' text input and a 'Warmup time' dropdown menu set to '100ms'. At the bottom of the page are 'Cancel' and 'Save' buttons.

Each control has the following two settings:

- Custom name: a name given to this control so it can be easily identified on other pages (e.g.: "Pump Control" or "Sensor Power").
- Warmup time: only used if this control is set up as a sensor warmup. This specifies the amount of time this control should stay active for before a sensor reading is taken.

5.4.1 Advanced – Control Considerations

The controls use a priority-based system to handle requests from alarms, warm-ups, and user control. There are a few rules which should be noted:

- If two or more alarms attempt to drive a control in opposite directions, the "OFF" command will override the "ON" command.
- A control cannot be used as both sensor warm-up and by an alarm at the same time. However, it may be configured to be used by multiple alarms, or multiple input channels as a sensor warm-up.
- If a control is configured to be used for sensor warm-up, it will be unable to be controlled via the web pages at any time.
- If an output is configured to be used by an alarm in 'Continuous' mode, it is able to be controlled via the web pages when the alarm is in the inactive state (not forcing the control), but cannot be controlled when the alarm is in the active state.
- If an output is configured to be used by an Alarm in 'pulse' mode, it is unable to be controlled via the web pages at any time.

5.5 Input Channels

The *Change Input Setup* page can be accessed from the *Change Setup* page by clicking on the *Input Setup* link.

In this screenshot, Digital 1 has been setup as an event channel connected to tipping bucket rain gauge, and Analogue 1 has been set up as a 4-20mA channel connected to a 4-20mA pressure sensor.

Note: On SDI-12 / RS-485 hydroSpiders, the second digital and analogue channels are replaced with intelligent interface channels (see *Appendix A - SDI-12 / RS-485* for more information).

hydroSpider2

Home >> Change Setup >> Change Input Setup

Change Input Setup

	Type	Source	Name	User ID	Units	Logging	
1	Event	Digital 1	Rainfall	0	mm	Auto	
2	Analogue (4-20mA)	Analogue 1	Water Level	1	mm	General	
3	Disabled						
4	Disabled						
5	Disabled						
6	Disabled						
7	System (Voltage)	Charger	Charger Voltage	6	V	General	
8	System (Temperature)	Temperature	System Temperature	7	C	General	

General logging period: 10m

General fast logging period: 1m

Logging offset: 00 hours 00 minutes

Cancel Save

Take a note of the various columns on the table:

- **Type:** Shows the base type of the channel as well as its selected type (see 5.5.1- *Native Inputs*).
- **Source:** Location on the input connector where the sensor is connected or, for system inputs, which system monitor to use.

Alternatively, for counter and event types, the **Virtual** source allows the channel to count alarm activations (see 5.10 - *Alarms* for more information).

- **Name:** The name of this channel. This is used in Filtered and Multi-Column reports and to identify the channel throughout the web interface.
- **User ID:** This is the channel ID shown in the user defined report type and can be adjusted as necessary. See *Appendix I - Report Formats* for more information.
- **Units:** The units of this channel. This will be seen when calibrating the unit and when viewing the current channel values on the *Inputs* page.
- **Logging:** Selects how often data logging takes place (if applicable).
- **Magnifying Glass Icon:** Clicking on this icon lets you get real time readings from the sensor. This is very convenient during installations and while troubleshooting sensors.
- **Options Icon:** This column contains a button which allows you to change additional channel options (see 5.5.6 – *Additional Input Options*).

At the bottom of the Change Input Setup page, there are also a number of global options which influence the way channels operate:

- **General Logging Period:** Specifies how often channel values are written to the log file, when that particular channels Logging option is set to “General”
- **General Fast Logging Period:** Specifies how often channel values are written to the log file, when an alarm requiring fast logging is active.
- **Logging offset:** Logging is normally done “on the hour” – if the logging period is 1 hr, the channel would normally be logged at 1:00am, 2:00am, etc. This setting makes it possible to shift the logging time. For example, if the logging period is 1 hr and the logging offset is 20 min, the channel will be logged at 1:20am, 2:20am, 3:20am, etc.

The logging offset also shifts the “midnight” log – if the logging offset is 6 hours, then every input channel will be logged at 6am each day.

5.5.1 Native Inputs

The native input channels can be configured to monitor switches, counters, voltage levels, and current flows. Native input channels support the following channel types:

- **Switch** – for use with switch closure or a voltage free contact. Typical uses include float switches, gates, and pump status.

Switch inputs detect either an active (“ON”) state or an inactive (“OFF”) state. The active state is indicated by shorting the input and ground terminals together, while the inactive state is indicated by the terminals staying open. A switch state must be stable for a minimum of 3 seconds to be recognised.

The state of a switch input is logged each time it changes state, whether to active or inactive. Additionally, the time the switch was active is also logged after it goes inactive.

- **Switch State** – for use with switch closure or a voltage free contact. Typical uses include float switches, gates, and pump status.

The Switch State type is similar to the Switch type, but instead of logging when the switch changes state, the current state of the switch is logged at defined intervals. Additionally the time for which the switch is active is not logged.

- **Counter** – typical uses include water and electricity meters. Counter inputs will increment each time the terminals are shorted¹. The hydroSpider supports pulse frequencies of up to 100Hz on its counter inputs. The counter will roll-over from 999,999 to 0.

- **Event** – typical uses include tipping bucket rain gauges. Event inputs are used to record occurrences of pulses¹. A pulse is generated by temporarily shorting the input terminals together. Event inputs are suitable for monitoring pulses that occur less frequently than once every 30 seconds and have widths of at least 5ms. Each time an event occurs, the hydroSpider logs the time of its occurrence as well as the total number of events. The total will roll-over from 999,999 to 0.

Note that the battery life will be dramatically reduced if a higher frequency signal is connected to an event input.

- **Quadrature** – typical uses include rotary encoders. Quadrature inputs can produce both positive and negative values with the count rolling over from 999,999 to -999,999 and vice-versa.
- **Difference** – typically used for flow meters with forward and reverse outputs. Difference inputs record the difference between two counter inputs. The value reported is the number of pulses counted on one input minus the pulses counted on the other input. Difference can produce both positive and negative values with the count wrapping around from 999,999 to -999,999 and vice-versa.
- **Analogue (4-20mA)** – typical uses include pressure, flow rate and pH sensors. The standard hydroSpider has two dedicated 4-20mA input channels, one on each analogue input. These channels are pre-calibrated and have all required biasing resistors built in. This channel is logged at the defined intervals.

¹ Counter and Event channels can instead be setup to count the number of times an alarm is triggered, by selecting the **Virtual** source and setting up an alarm to increment or reset the virtual counter. See 5.10 - Alarms for more information.

- **Analogue (Voltage)** – typical uses include pressure, temperature weight etc. Analogue inputs can also be configured for use with voltage sensors, typically 0 – 2.4V however other ranges are easily accommodated (see *Appendix H6 - Voltage output sensors*). This channel type is logged at the defined intervals.
- **Analogue (Switch)** – typical uses include float switches, sunshine sensors etc. Each analogue input can be configured for use with a switch (contact closure or voltage free contact) or sensor with digital output.

The Analogue (Switch) type is similar to the Switch State type, logging the state of the switch at each logging period. The time for which the switch is active is not logged.

When used with a switch, the input will read as "ON" when the switch contact is closed. When used with a sensor, the input will read as "ON" if the input voltage is less than 1.25V, and "OFF" if the input is between 1.25 and 2.5V. Other voltage ranges can be supported by using external resistors, as shown in Appendix H6 - Voltage output sensors.

Note that there is no galvanic isolation between different inputs nor between inputs and the hydroSpider internal circuitry.

5.5.2 System Inputs

Each hydroSpider provides a number of system channels which can be used to monitor the hydroSpider's hardware. The following system channels are available:

- **External Battery Voltage:** measures the voltage of the external battery on the *BATT* port.
- **Charger Voltage:** measures the voltage of the charger input on the *CHG* port.
- **System Temperature:** measures the temperature inside the hydroSpider enclosure.
- **System Moisture Detector:** measures moisture present on the main circuit board, as a value between 0 (board is dry) and 100 (very wet). This input can be helpful in preventing hydroSpider damage due to exposure to moisture for prolonged periods of time.

System input channels can be used for logging and triggering alarms in the same way as other channels, but their type cannot be changed.

5.5.3 System Parameters

Inputs configured as system parameters get their data from an attribute of the unit's hardware, software or current configuration.

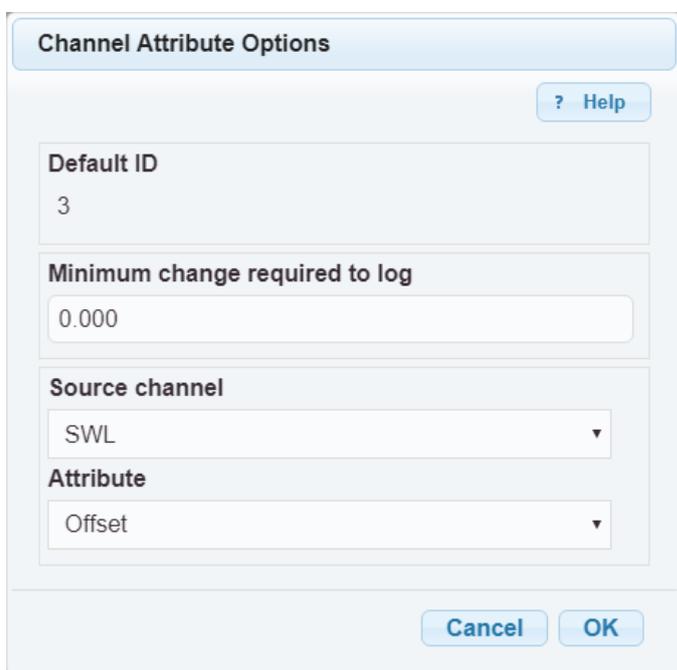
System parameter channels are included in reports and can be used to trigger alarms, in the same way as native or system input channels.

To setup a system parameter, select "System (Parameter)" as the channel type and then select the source as described below.

5.5.3.1 Channel Attribute

These system parameters read the current value of an attribute associated with another channel.

The channel attribute can be selected via the advanced input options dialog (the 'cog'):



The screenshot shows a dialog box titled "Channel Attribute Options". It contains the following fields and controls:

- A "Default ID" text box containing the value "3".
- A "Minimum change required to log" text box containing the value "0.000".
- A "Source channel" dropdown menu with "SWL" selected.
- An "Attribute" dropdown menu with "Offset" selected.
- A "? Help" button in the top right corner.
- "Cancel" and "OK" buttons at the bottom.

The **Source channel** specifies which input channel to get the attribute from.

The following channel attributes, selectable from the **Attribute** drop-down list, are currently available:

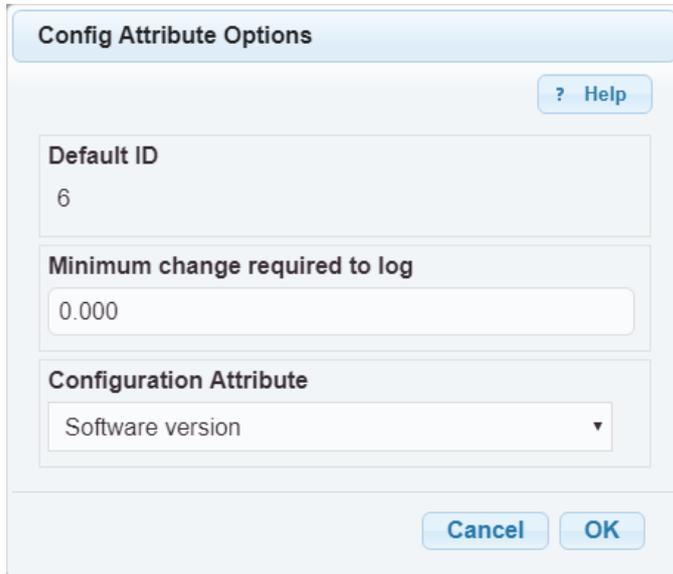
- **Offset** and **Scaler**: These attributes make it possible to report a channel's calibration settings (see [Input Channel Calibration](#) for more details).
- **Divisor**: Reports the pulses per unit setting for a counter, event, difference or quadrature channel.

For example, the Offset attribute can be used to report the offset associated with an SWL measurement.

5.5.3.2 Config Attribute

These system parameters read the current value of an attribute of the system software, or one of the unit's configuration parameters.

The config attribute can be selected via the advanced input options dialog (the 'cog'):



The screenshot shows a dialog box titled "Config Attribute Options". It features a "Help" button in the top right corner. The dialog is divided into three main sections. The first section, "Default ID", has a text input field containing the number "6". The second section, "Minimum change required to log", has a text input field containing "0.000". The third section, "Configuration Attribute", has a drop-down menu currently displaying "Software version". At the bottom of the dialog are "Cancel" and "OK" buttons.

The following attributes, selectable from the Configuration Attribute drop-down list, are currently available:

- **Software version:** Reports the current software version as a numeric value.

5.5.4 Super Channels

Super channels enable the user to feed one or more existing channels (native or system) into a super channel to transform the input data.

The following super channels are currently available:

- **Rating Table:** Takes an input channel and applies linear or logarithmic interpolation based on a lookup table generated by Hydstra software.
- **Ax + By + C:** Takes two input channels and adds or subtracts them, optionally scaling the inputs and/or adding a fixed offset. Most commonly, this allows the sum or difference of two inputs to be calculated.
- **Evapotranspiration:** Uses the Hargreaves model to calculate estimated daily evapotranspiration, based on mean daily temperature and total solar radiation.
- **Wind Speed and Direction:** Various methods for calculating average wind speed or direction, or Sigma Theta (standard deviation) of wind direction are available:
 - **Wind Speed Vector Avg** and **Wind Direction Vector Avg:** These methods each take two inputs representing instantaneous wind speed and direction, and combine them to calculate the vector average wind speed and direction.
 - **Wind Direction Average:** Takes an input representing instantaneous wind direction and calculates the average direction, correctly handling the transition between 360 and 0 degrees.
 - **Wind Direction Sigma Theta:** Takes an input representing instantaneous wind direction and uses the Yamartino method to calculate the standard deviation of the wind direction.

The average or standard deviation is calculated over the super channel's logging period in each case.

- **SWL:** Calculates the standing water level of a bore, based on head of water.

Super channels are included in reports and can be used to trigger alarms, in the same ways as native or system input channels.

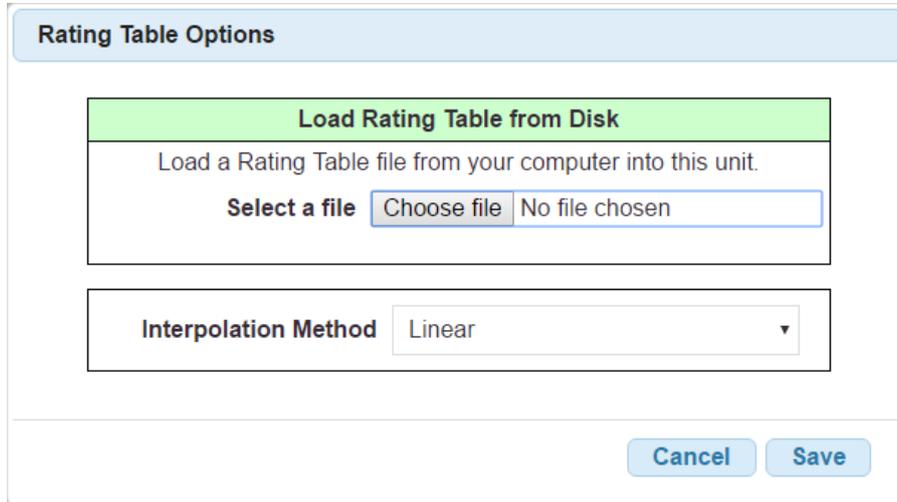
In general, super channels cannot be calibrated, because it is assumed that the input channels are already calibrated, and the super channels perform their calculations or lookups based on the calibrated input readings.

An exception is the SWL channel, which must be calibrated to set the current reading. The correct offset will then be automatically calculated.

5.5.4.1 Rating Table

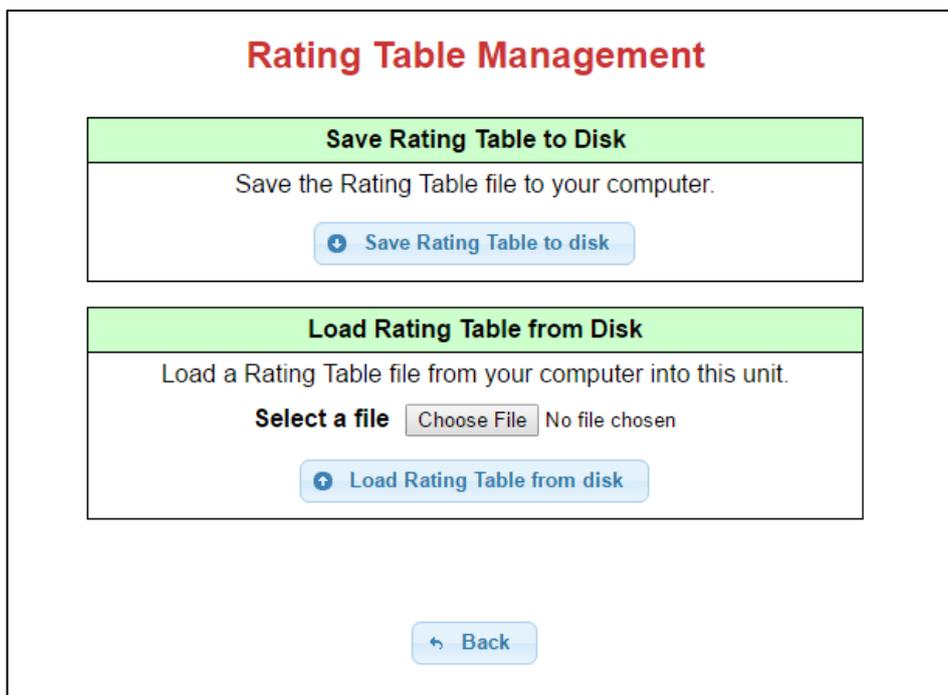
When a rating table is selected as the source for a super channel the input to the rating table can then be chosen via the advanced input options dialog.

A new button also becomes available at the bottom of the Change Input Setup page, *Rating Table Options*. It opens the following window:



These options allow the user to upload a rating table generated from the Hydstra software and select the Interpolation Method to be used. The options are **Linear** and **Logarithmic**.

The existing rating table can be downloaded or a new rating table uploaded via the *Rating Table Management* page, which becomes accessible via the *Change Setup* page after a Rating Table Super Channel has been set up:



5.5.4.2 Ax + By + C

This type of super channel performs the calculation

$$value_{calculated} = (A \times value_{input\ x}) + (B \times value_{input\ y}) + C$$

where A and B are scaling factors (which can be negative), x and y are the inputs to the calculation, and C is a fixed offset which can be added to or subtracted from the result.

When "Ax + By + C" is selected as the source for a super channel the inputs to the calculation can then be chosen via the advanced input options dialog (the 'cog'):

The screenshot shows a dialog box titled "Options" with a "Help" button. The "Default ID" is set to 2. The "Log difference in reading over logging period" checkbox is unchecked. The "Minimum change required to log" is set to 0.000. The "Ax + By + C" section is highlighted in yellow and contains the following settings:

Parameter	Value
A	1.000
x	Depth pressure
B	-1.000
y	Surface pressure
C	0.000

At the bottom of the dialog are "Cancel" and "OK" buttons.

For example, to accurately determine water depth from a pressure measurement, the atmospheric pressure should be subtracted from the pressure at depth. This can be done by setting A = 1 and B = -1, as shown.

If you also wanted to convert pressure (e.g. bars) to metres in the same calculation, you would enter the appropriate scaling factor, e.g. A = 10.19 and B = -10.19.

5.5.4.3 Evapotranspiration

This type of super channel performs the calculation

$$ET_0 = 0.0135 \times (T_m + 17.78) \times \frac{R_s}{1000} \times \frac{238.8}{595.5 - (0.55 \times T_m)}$$

Where:

ET_0 = Evapotranspiration in mm/day

T_m = Mean daily temperature in °C

R_s = Daily solar radiation in kJ/m²/day

When “Evapotranspiration” is selected as the source for a super channel the inputs to the calculation can then be chosen via the advanced input options dialog (the ‘cog’):

Total Solar Radiation is the total sunlight accumulated in a day, measured in kJ/m²/day.

To calculate total solar radiation, set up a channel which reads a solar radiation sensor, with the logging period set to one day and a sample period short enough to capture sunlight variation through the day, for example 15 minutes, and select the **Integrate** filter type.

If your radiation sensor outputs W/m² instead of kW/m², you must also select the **Divide Samples by 1000** option, to convert W to kW. The integrated value will then be in kJ/m²/day, as required by the evapotranspiration calculation.

Mean Temperature is the average daily temperature. To calculate it, setup a channel which reads an air temperature sensor calibrated in °C, with the logging period set to one day and a sample period short enough to capture temperature variation through the day, for example 10 minutes, and select the **Average** filter type.

Note that the evapotranspiration, total solar radiation and mean temperature channels must all have the same logging period which, for the calculation to be valid, should be set to 1 day.

5.5.4.4 Wind Speed and Direction

When **Wind Speed Vector Avg** or **Wind Direction Vector Avg** is selected as the source for a super channel, the instantaneous wind speed and direction inputs can then be chosen via the super channel's advanced input options dialog:

The screenshot shows a dialog box titled "Avg wind direction Options". It includes a "? Help" button in the top right. The "Default ID" field is set to "2". The "Log difference in reading over logging period" checkbox is unchecked. The "Minimum change required to log" field is set to "0.000". The "Speed Input channel" dropdown is set to "Wind speed". The "Direction Input channel" dropdown is set to "Wind direction". The "Sampling period" dropdown is set to "1 minute". "Cancel" and "OK" buttons are at the bottom.

The direction input channel should be calibrated in degrees, to ensure that the transition between 360 and 0 degrees is correctly handled.

The **Sampling period** specifies how often the inputs are sampled to calculate the average.

For example, with 10 minute logging and 1 minute sampling, 10 readings, each 1 minute apart, will be used to calculate each average value.

The sampling period must be faster than the super channel's logging period. The sampling or logging period of the input channels will be adjusted automatically as required by the super-channel's sampling period.

When **Wind Direction Average** or **Wind Direction Sigma Theta** (standard deviation, using the Yamartino method) is selected as the source for a super channel, the options dialog is the same as shown above, except that the wind speed input is omitted because only wind direction is utilised by these two methods.

5.5.4.5 SWL

This super channel calculates the standing water level of a bore, using the calculation:

$$SWL = Offset - Head$$

where Offset is automatically calculated by the logger and Head is the water level above a (typically pressure) sensor suspended in the bore.

The head channel should be setup first, and calibrated to read water depth in metres.

It can then be selected in the SWL super channel's input options dialog:

When the bore is dipped, the measured value can be set by calibrating the SWL channel, selecting the “Change Offset Only” option and then entering the desired value.

When you save the new calibrated value, the SWL channel offset will be calculated automatically.

For reporting purposes, the SWL offset can be accessed by setting up a system parameter channel, with the SWL channel as the source, and “Offset” as the parameter type.

5.5.5 Channel Logging

Channels log differently depending on their channel type:

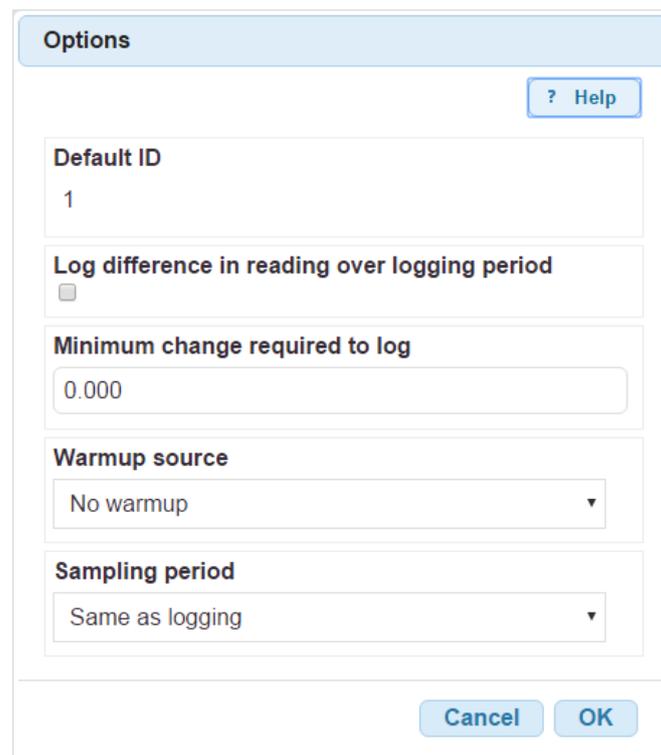
- Switch type channels automatically log any input change. If a switch input turns ON and then back to OFF, both of these changes are logged separately, including the duration (in seconds) for how long the switch was in the ON state.
- Event channels automatically log a single record per pulse²
- All other channel types log at a regular interval (called the *logging period*), which can be specified individually for each channel.

Regardless of the logging period or channel type, all channels are logged automatically every midnight. This ensures that at least one sample is recorded every day, even with slowly varying inputs.

5.5.6 Advanced – Additional Input Options

Each channel type has a number of configurable options which can change the channel's behaviour or provide additional data.

To change a channel's options, simply click on the options button (the 'cog') to the right of the channel. This will bring up a dialog:



The image shows a dialog box titled "Options". It has a light blue header bar with the title "Options" and a "? Help" button in the top right corner. The dialog contains several sections:

- Default ID:** A text input field containing the number "1".
- Log difference in reading over logging period:** A checkbox that is currently unchecked.
- Minimum change required to log:** A text input field containing "0.000".
- Warmup source:** A dropdown menu with "No warmup" selected.
- Sampling period:** A dropdown menu with "Same as logging" selected.

At the bottom of the dialog are two buttons: "Cancel" and "OK".

Options dialog

² Log records are generated no more than once per second. If more than one pulse is detected on an event channel in a single second, the number of pulses counted during that second will be logged.

5.5.6.1 Default id

This is the channel value shown in the raw and diagnostic report types. These are fixed for each channel and cannot be adjusted. See Appendix I - Report Formats for more information.

5.5.6.2 Log difference in reading over logging period

Applies to: All (except Switch inputs)

When “log difference in reading” is enabled, the amount that the input value has *changed* in each logging period is recorded.

For example: a counter is setup to log every 1 hour with “log difference” enabled and the count is 100 at the start of the hour and 105 at the end of the hour. The count changed by 5 during that hour, so the value logged at the end of the hour will be ‘5’.

This provides a way to perform utility metering, where the number of pulses in each logging period has to be recorded.

The type of difference to be logged can be selected from a drop-down menu:

- **Any** will log any difference since the last reading, whether positive or negative
- **Positive differences only** will ignore negative differences, logging them as zero
This can be used to avoid reporting a negative accumulation when a counter is reset

5.5.6.3 Minimum change required to log

Applies to: All (except Switch and Event inputs)

The “Minimum change required to log” setting specifies the minimum change in value that has to occur before the channel value is logged again. This is most useful for slowly-changing inputs: setting a minimum-change-to-log ensures that the channel is only logged when it changes by a certain amount rather than repeatedly logging the same or a similar value each logging period.

For example: a channel is set with a minimum change to log of 5. Its last log entry reads 150. Now, in the next logging period, the channel is sampled and its value is 153. The change since last log is only 3, and since its minimum change to log is set to 5, this value is NOT logged. The following logging period the channel reads 156. This is now 6 higher than the last logged value (150) so this value is logged, and 156 becomes the last logged value. Note that this also applies to negative changes (eg: going from last logged value of 150 to a new reading of 145 will also trigger a log).

Note that if the minimum change to log setting is non-zero, any error codes (resulting from a malfunctioning or disconnected sensor) will be logged once only, until a different error code or valid reading is recorded.

5.5.6.4 Force log

Applies to: Channels with a minimum change required to log

This setting allows a channel, which has been set to log only when a minimum change has occurred, to also be logged periodically.

For example: a channel's log period is set to 5 minutes, and its force log period is set to 1 hour. The channel's value will be logged every hour, regardless of whether the value of changed. Additionally, the input will be sampled every 5 minutes and the value logged if it has changed by more than the minimum change amount.

5.5.6.5 Sampling Period

Applies to: All Analogue input types, Intelligent Inputs, Switch State, System Monitors

The Sampling Period is the period at which readings are taken on the channel (called sampling). If this is set to less than the logging period, the logged value will be calculated from the readings sampled during the logging period, depending on the Filter Type:

5.5.6.6 Filter Type

Applies to: All Analogue input types, Intelligent Inputs, Switch State, System Monitors

When a channel is configured to sample more often than it logs, the Filter Type selects the type of calculation which will be performed on the samples:

- **Average:** the average of all the samples taken within the logging period will be logged. This is useful to increase the reading's accuracy or monitor fast-changing data without logging all of these fast changes.
- **Integrate:** the samples are totalled and multiplied by the duration of the sampling period in seconds. This can be used, for example, to convert a flow rate (kl/s) into a volume (kl), or power readings (kW) into accumulated energy (kJ).

Note that filtering will only occur when the sampling period is less than the logging period. If both periods are the same, then the hydroSpider2 will simply log every sampled value.

5.5.6.7 Divide Samples by 1000

Applies to: Channels with Integrate filter type

This option divides each sample reading by 1000 before it is integrated. This may be necessary to ensure that the total (integrated) value does not exceed the maximum value of 999,999.99 that can be logged by the hydroSpider2.

For example, if a flow rate measured in kl/s is being integrated to calculate volume, selecting this option means that the resulting volume will be measured in Ml instead of kl.

5.5.6.8 Log Min/Max

Applies to: Analogue 4-20mA, Analogue Voltage, Intelligent Inputs, System Monitors

If a channel is configured to sample more often than it logs, the Min / Max logging feature becomes available. The Min / Max logging option will, in addition to logging the average value, log the minimum and maximum sampled values during each logging period. This is useful if, for example, you wish to monitor the minimum, average, and maximum water level in a pipe over the course of the logging period without having to increase the logging rate.

For example: consider a hydroSpider2 which has its logging period is set to 3 minutes, and also has an analogue channel configured with a 1 minute sampling period with filter type set to average and min/max logging. If the following data is sampled:

Time	Sampled Value
12:30:00	114.15
12:31:00	115.15
12:32:00	112.15

Then at the logging period the average of 113.816 will be logged. Additionally, the minimum 112.15 and the maximum 115.15 will also be logged.

Note that the minimum and maximum values will be logged with additional identifiers so that they are clearly distinguishable from the average value. Refer to Appendix I - Report Formats for more details on report identifiers.

5.5.6.9 Periodic Reset

Applies to: Counter, Event

If selected, the channel will automatically have its value reset to 0 regularly, after a user-selectable period of 1, 3, 6, 12 or 24 hours. This is useful if you want the channel reading to show you the current daily or hourly reading.

For example: a tipping bucket rain gauge is set up and connected to a Counter input. This channel is set up with the Periodic Reset option, and the period is set to 24 hours. With these settings, the counter will be reset to 0 at Midnight every day. The count value logged by this input channel now therefore represents the amount of rain that has fallen in the 24-hours since the Midnight reset. Without periodic reset, this input channel would continue to count rainfall from when it was first set up, rather than the (often more useful) rainfall-per-day value.

5.5.6.10 Warm-up source

Applies to: Analogue 4-20mA, Analogue Voltage, Intelligent Inputs

The Warm-up source for a channel is the control which is turned on before a reading is taken. This is most often used to power up the sensor. The warm-up source has a warm-up period associated with it, which is the duration the sensor is powered up before a reading is taken (so the sensor has time to power up/stabilise). Using a warm-up is very useful for conserving battery life when the sensor doesn't need to be permanently powered (as is the case for most 4-20mA and Voltage sensors).

For example: An analogue channel is set with Switched Power Out as its warm-up source, and the warm-up period is set to 5 seconds. 5 seconds before this channel is due to be sampled, the Switched Power Out control is automatically turned on. 5 seconds later, the channel is sampled, and the Switched Power Out control is turned back off. This warm-up process repeats for every sample performed.

5.5.6.11 Report megalitres as kilolitres

Applies to: Counter with Units = "ML"

This option is intended for use with a water meter, where the counter input is calibrated in megalitres. When this option is selected, all data logged for this channel will be reported in kilolitres instead of megalitres (applies to Filtered, Multi-column and User ID reports only).

Note that this only applies to how the channel's readings are presented in reports. It does not affect the values shown on the View Inputs, Calibration or Alarms pages, which will continue to display in megalitres.

5.5.6.12 Rating Table Input

Applies to: Rating Table

The rating table uses this as the source for the lookup table interpolation.

For example: This is set to an analogue channel reading a calibrated value of 100. This value is then used to look for a match within the Hydstra table uploaded to the device. If an exact match is not found then interpolation is used to calculate the output value from the two nearest matches. The resulting value is what is then logged.

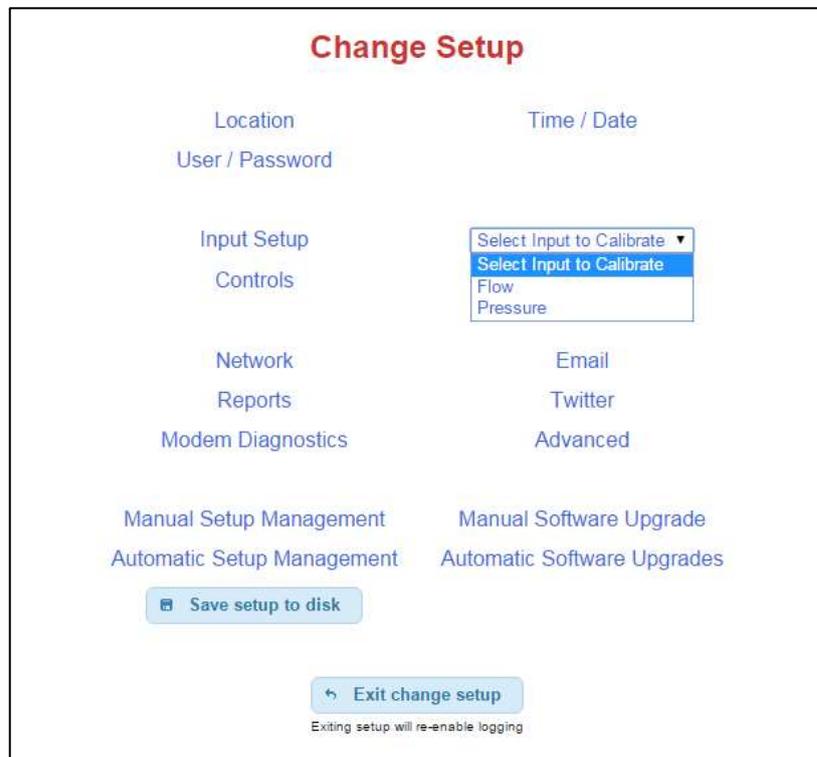
5.6 Input Channel Calibration

Calibration refers to changing the range of values which a channel produces so that it matches a real-world value. By default, counter channels increment by 1 each count, analogue voltage channels report a value between 0 and 4095, and analogue 4-20mA channels report a value between 4 and 20. More often than not, these are not suitable for the application at hand, and so channel calibration is used.

Calibration of a channel is linear and makes use of a scaler and an offset. The following formula is used for all channel calibration:

$$value_{calibrated} = (value_{raw} \times scaler) + offset$$

Once the channels have been set up, calibration can be accessed using the drop down on the left hand side of the Change Setup page, shown below:



Change Setup page showing location of the channel calibration dropdown box

This takes you to a “Channel Calibration” page, where you can select the calibration method to be used.

There are a number of different calibration methods available in the hydroSpider2. Only those appropriate for the input being calibrated will be listed on the “Channel Calibration” page.

They are all covered in the following sections.

5.6.1 4-20mA Calibration

Applies to: Analogue (4-20mA)

The hydroSpider's 4-20mA channels are factory calibrated, therefore on the 4-20mA calibration screen you only need to enter the values that correspond to the sensors 4mA and 20mA readings.

The hydroSpider will then automatically work out the correct scaler and offset values.

Channel Calibration

Water Level

Sensor low (4mA) reading m

Sensor high (20mA) reading m

For example: A 4-20mA pressure sensor is measuring water level the 4mA reading corresponds to 0 metres, and a 20mA reading which corresponds to 10 metres. The number 0 is entered into the first field, and the number 10 is entered into the second field. This channel will now produce values between 0 metres and 10 metres.

5.6.2 Manual calibration (counter)

Applies to: Counter, Event, Difference, Quadrature

Channel Calibration

Rainfall

1 mm = pulses (0.200 mm per pulse)

Desired Value:

Calibrated Value: 3.200 mm

Manual counter calibration screenshot

Manual counter calibration has the following fields:

- **Pulses per unit:** This option specifies how many pulses represent one unit of measure.
- **Desired value:** This is used to make the hydroSpider's reading match the current reading on the sensor (if given). Simply enter the sensor's reading as the desired value and the hydroSpider will start counting from there.

This page also shows the current calibrated value, which can be updated at any time by clicking the *Update* button.

For example: A tipping bucket rain gauge pulses each time the bucket tips. A common bucket size is 0.2 mm therefore by entering 5 in the pulses field you will see that it will take 5 pulses per mm of rainfall (0.2mm per pulse). If there has already been rainfall we can set the “Desired Value” to reflect this, in this case 3.2mm. The next time the bucket tips the count will be 3.4mm

5.6.3 Manual calibration (analogue)

Applies to: Analogue (Voltage), Analogue (4-20mA), Intelligent Sensors

Manual calibration of analogue channels allow both the offset and scaler (as seen in the calibration equation) to be adjusted.



Channel Calibration

Pressure

Raw value: 1159

Scaler:

Offset:

Calibrated value: 23.180 bar

Manual analogue calibration

This page also shows the channel's current raw value which ranges between 0 and 4095, and the current calibrated value.

These values can be updated at any time by clicking the *Update* button.

5.6.4 Change Offset Only

Applies to: Analogue (Voltage), Analogue (4-20mA), Intelligent Sensors

Change offset only is used when the scaler has already been set to the correct value, but the sensor is constantly off by a fixed amount.



Channel Calibration

Water Level

Desired Value:

Calibrated value: 1.500 m [Update](#)

[x Cancel](#) [✓ Save](#)

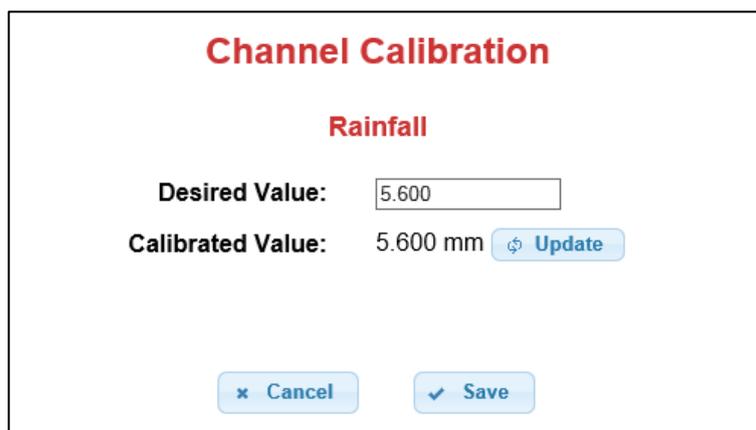
This page also shows the current calibrated value, which can be updated at any time by clicking the *Update* button.

For example: take the scenario where a pressure sensor is being used to determine the level of water in a tank. This pressure sensor has been calibrated at the office, but when it is installed into the tank on site, a mounting bracket places it 0.25m off the tank floor. This means that the reading will constantly be 0.25m less than the actual water level. This can be easily remedied by performing a *change offset* calibration on this.

5.6.5 Change Desired Value (counter)

Applies to: Counter, Event

Change Desired Value is used when the count on a counter or event has to be updated to make the hydrospider2's reading match the current reading on the sensor, which may become necessary if some pulses have been missed – perhaps because the sensor was temporarily disconnected or has been reset.



Channel Calibration

Rainfall

Desired Value:

Calibrated Value: 5.600 mm [Update](#)

[x Cancel](#) [✓ Save](#)

Simply enter the sensor's reading as the desired value and the hydroSpider will start counting from there.

This page also shows the current calibrated value, which can be updated at any time by clicking the *Update* button.

5.6.6 Advanced: 2-point calibration

Applies to: Analogue (Voltage), Analogue (4-20mA)

2-point calibration automatically determines the appropriate scaler and offset by taking two raw readings (a low reading and a high reading) and having the user enter each reading's associated real-world value.

The two point calibration page will lead you through a series of steps, after which the hydroSpider will calculate the correct offset and scalar to use based on the entered data.

For example: a voltage pressure sensor is being used to measure the water level in a tank. An analogue voltage channel, "Level", is set up and configured with units of cm. 2-point calibration is chosen from the channel's calibration menu.

The first step in two point calibration is to generate a minimum value in the sensor. For this purpose, the sensor immersed in 20cm of water and a reading is taken.

The desired reading is therefore entered as 20, and the raw reading is updated to show 178.

Channel Calibration

Water Level

1. Set transducer to minimum value
2. Enter desired reading:
3. [Click here](#) to lock 1st point with raw value = 178.000 [Update](#)

[Cancel](#) [Save](#)

2-point calibration steps 1-3

These two values are then locked in by clicking the *Click here* button.

The next step is to generate a large value in the sensor. For this purpose, the sensor is immersed in 290cm of water and a reading is taken. The desired reading is therefore entered as 290, and the raw reading is updated to show 3783.

Channel Calibration

Water Level

1. Set transducer to minimum value
2. Enter desired reading:
3. LOCKED to: 178
4. Set transducer to maximum value
5. Enter desired reading:
6. [Click here](#) to lock 2nd point with raw value = 3783.000 [Update](#)

[Cancel](#) [Save](#)

2-point calibration steps 4-6

This second pair of numbers is locked in via the *Click here* button

Channel Calibration

Water Level

1. Set transducer to minimum value
2. Enter desired reading:
3. LOCKED to: 178
4. Set transducer to maximum value
5. Enter desired reading:
6. LOCKED to: 3783

Completed 2-point calibration

The 2-point calibration procedure is now complete. Click the save button to save these values to the hydroSpider.

Note: the two calibration points can be any value in the sensor's range, but must be separated by at least 1000 raw counts for analogue voltage inputs, or at least 4mA for 4-20mA inputs. If they are less than this amount apart, then 2-point calibration will fail and the procedure must be restarted. In general, larger spacing between readings results in better reading accuracy

5.7 Network Parameters

The hydroSpider network settings are split into sections: Local Area Network (LAN), Primary Network, Secondary Network and (optionally) Transmit Mode.

To set up the network parameters, click the *Network* link on the *Change Setup* page. You will be presented with the *Change Network Settings* page, shown below:

Change Network Settings

Local Area Network

IP address	<input type="text" value="192.168.0.177"/>
Network mask	<input type="text" value="255.255.255.0"/>
Gateway	<input type="text" value="192.168.0.1"/>
Easy Connect	<input checked="" type="checkbox"/>

LAN is used for local (Ethernet) connections to this unit.

Primary Network

Method	<input type="text" value="Mobile Internet (Modem)"/>
APN	<input type="text" value="telstra.internet"/>
Authentication	<input type="checkbox"/>
Data limit	<input type="text" value="1.000"/> MB/day
Report signal strength	<input checked="" type="checkbox"/>
Signal strength name	<input type="text" value="Modem Signal"/>
Signal strength format	<input type="text" value="Percentage (%)"/>
SMS Recovery period	<input type="text" value="Weekly"/>
Modem phone number	<input type="text"/>

Secondary Network

Method	<input type="text" value="None"/>
--------	-----------------------------------

5.7.1 Local Area Network

For most users, these settings need not be changed as the hydroSpider2 can connect directly to a PC using a LANlink cable (see 4.1 - Connecting to the hydroSpider for details).

This section has the following fields:

- **IP address:** This is the IP address that you will use to communicate with the hydroSpider2. The default address is 192.168.0.177 and is suitable for most circumstances, but may need to be changed if the unit is to be connected to a network. Please consult your network administrator.
- **Network mask:** May need to be changed if the hydroSpider2 is going to be connected to a network. Please consult your network administrator for assistance.
- **Gateway:** May need to be changed if the hydroSpider2 is going to be connected to a network. Please consult your network administrator for assistance.
- **Easy Connect:** If your hydroSpider2 is connected straight to your computer/laptop (i.e. not to a network – see 4.1 - Connecting to the hydroSpider), Easy Connect will remove most (if not all) setup steps required to begin interacting with the web interface.

Easy Connect should be disabled if the hydroSpider2 is to be connected to a network.

Note: changes to LAN settings will take effect after the LANLink cable is disconnected and reconnected.

5.7.2 Primary Network

The primary network is utilised to connect to the Internet in order to send reports and emails, tweet, synchronise the clock via NTP, and perform automatic software and setup updates.

Internet access can be gained from either a LAN connection or the unit's internal mobile modem, which is selectable from the **Method** setting.

5.7.2.1 Mobile Internet (Modem)

This device will use its inbuilt mobile modem to connect to the Internet. A SIM card and antenna must be installed, and the following settings configured:

- **APN:** This needs to be set according to your SIM card instructions. Telstra SIM cards commonly use "telstra.internet", Optus SIM cards commonly use "internet", and Vodafone SIM cards commonly use "live.vodafone.com". Please consult your SIM card documentation or contact your provider.
- **Authentication:** Enable this option if it is required by your SIM card. This is not needed in most cases. Please consult your SIM card instructions or contact your SIM provider.
 - **Authentication method:** The default method is PAP, which is usually suitable. Some private networks may require CHAP authentication. Please consult your SIM provider for assistance.
 - **Username and Password:** assigned for use with this SIM card
- **Data limit:** The maximum amount of data that can be sent out per day. After this limit is reached, no further reports will be sent until the next midnight.

- **Report signal strength:** Signal strength is logged whenever this unit connects to the mobile Internet. Enable this option to include these signal strength records in reports (including a column in multi-column reports).
- **Signal strength name:** Name of the signal strength channel as it appears in Filtered and Multi-column reports.
- **Signal strength Format:** Signal strength can be reported either as a percentage (0% to 100%), or in power units (-113dBm to -51dBm).
- **SMS Recovery period:** See 5.7.5 - SMS Recovery, below.
- **Mobile phone number:** Record the SIM card's phone number here, for your future reference. NOTE: the phone number must be entered manually; it is NOT obtained automatically from the SIM card.

5.7.2.2 Local Network (LAN)

This device will use its Ethernet LAN connection to connect to the Internet.

- **DNS servers:** DNS servers are used to resolve any hostnames. By default, the two servers are set to Google's Public DNS servers 8.8.8.8 and 8.8.4.4 and will work for most applications. Please consult your network administrator for assistance.

5.7.3 Secondary Network

The secondary network can be setup to provide an alternative method of sending reports, in case the primary network method fails.

It would normally be used with an (optional) satellite modem, for use in remote locations to ensure that logged data is sent, even if the mobile network fails. Please contact Halytech for more details.

However it may be useful in a LAN environment to be able to send reports via mobile modem if the Ethernet connection is not available, in which case LAN would be selected as the primary network and mobile modem selected as the secondary network.

The type of network connection is selectable from the **Method** setting, in the same way as for the primary network.

If the secondary method is set to **None**, only the primary network will be used.

NOTE: the secondary network is only used to send reports. It is not used for sending emails, automatic software updates etc.

5.7.4 Transmit Mode

When a secondary network has been selected, the way it is utilised is determined by the **Transmit mode** setting:

- **Fail over:** The report is initially sent via the primary network and then, if the report could not be successfully sent, it is sent via the secondary network method.
- **Both:** The report is always sent by both network methods, regardless of whether the primary method fails.

Note that "Both" mode is only applicable when one of the network methods is satellite. When using both LAN and mobile modem, the only available transmit mode is "Fail over".

5.7.5 SMS Recovery

If an SMS is sent to the hydroSpider2 when its modem is off, the message will be held at the Network (Telstra, Optus, Vodafone, etc) and delivered once the hydroSpider's modem is turned on. However, there is no guarantee of how long it will take for the incoming message to be delivered to the hydroSpider once its modem does turn on. This means that if, for example, the hydroSpider turns the modem on to send out a report, then the hydroSpider may finish sending the report and turn off the modem before the SMS message is delivered.

The SMS recovery option solves this problem by having the hydroSpider leave the modem on for up to 3 minutes at the specified interval (never, daily, or weekly). This 3 minute window provides the mobile network extra time to deliver the SMS message to the hydroSpider. SMS recovery happens after the daily report is sent out, so reporting must be enabled for this option to have any effect.

For example: A hydroSpider has its SMS recovery option set to *Daily*. A Daily Report E-mail is being sent at 00:00:00 (midnight). The hydroSpider turns the modem on at 00:00:00 and sends out the report. The report finishes sending at 00:01:00. Normally this is the point that the modem is turned off, but because SMS recovery is set, modem will remain on until 00:03:00 (a total of 3 minutes) to provide extra time for incoming SMS messages to be received.

Note: SMS recovery will not take place if reporting is disabled.

Note: Setting SMS recovery to *Never* will not stop hydroSpider from receiving SMS messages, but rather means that the hydroSpider will not provide this extra window for SMS messages to be received. It is still possible that the SMS is received whenever the modem turn on, but it is less likely.

Note: SMS recovery does not guarantee the SMS message will be received, but does make it much more likely.

Note: SMS recovery will have no effect if the Live SMS option is enabled.

5.8 Email

Email settings must be configured before the hydroSpider2 can send email alerts and email reports.

To configure your email settings, click the *Email* link from the *Change Setup* page. You will be presented with the *Change Email Settings* page, shown below:

Change Email Settings

Email Account

"From" email address

SMTP mail server

Authentication

Note: SSL and TLS connections are not supported.

Email Test

This test sends an email with subject "Test Mail".

Email Address

- **"From" email address:** this is the email address the hydroSpider will use to identify itself. All emails received from the hydroSpider will have this as the "From" address. This must be set to a valid address which is acceptable to your mail server.

In the event that an email is sent by your hydroSpider but cannot be delivered, this address will usually be sent a failure notice by your mail server. It is therefore recommended to monitor this email address to detect failure notices.

- **SMTP mail server:** the mail server which will be used to send the hydroSpider's emails.

In Australia, SIM providers give access to free mail servers. At the time of writing, the Telstra mail server is "mail.bigpond.com", the Optus mail server is "mail.optusnet.com.au", and the Vodafone mail server is "smtp.vodafone.net.au". Please consult your network administrator or SIM provider for assistance.

The hydrospider uses the standard SMTP port 25 to connect to the server, unless authentication (see below) is enabled, in which case it will connect via port 587. Some third-party mail servers do not accept connections on port 25 – to use those servers you should enable authentication.

Note that encrypted connections, including SSL and TLS, are not supported.

- **SMTP authentication:** In Australia, the free mail servers provided by the SIM carriers do not require authentication. Authentication should only be enabled if the mail server you are connecting to requires it.
 - **Username:** SMTP username
 - **Password:** SMTP password
- **Send Test E-mail:** This test attempts to send an email to the nominated Email Address. This is useful for checking that your Email settings are correct and that your hydroSpider2 has access to mobile internet.

5.9 Twitter

The hydroSpider is capable of posting messages to Twitter (called Tweeting™). This is useful if you want alerts to go out to a large or constantly-changing list of people.



To set up your hydroSpider so that it can Tweet, you must first have a Twitter account. You can sign up at www.twitter.com.

Next, follow the steps on <http://www.halytech.com.au/twitter>. These steps will generate what is called your oAuth token and oAuth token secret. These strings are used by the hydroSpider to securely Tweet on your behalf.

Both the oAuth token and oAuth token secret should be copied exactly into the corresponding fields on the hydroSpider's *Change Twitter Settings* page. It is recommended to use the copy and paste features of your computer to avoid any typing errors since they are long strings and many characters can look similar to each other (eg: O and 0, as well as l, I, and 1).

This *Change Twitter Settings* page can be accessed by clicking the *Twitter* link on the *Change Setup* page.

The screenshot shows a web form titled "Change Twitter Settings" in red text. Below the title is a light green header box labeled "Twitter Account". Underneath, there are two input fields: "oAuth Token" and "oAuth Token Secret". Below these fields is a small grey box containing the text: "Your Twitter oAuth details can be retrieved by going to halytech.com.au/twitter (requires internet access)." At the bottom of the form are two buttons: "Cancel" with a red 'x' icon and "Save" with a green checkmark icon.

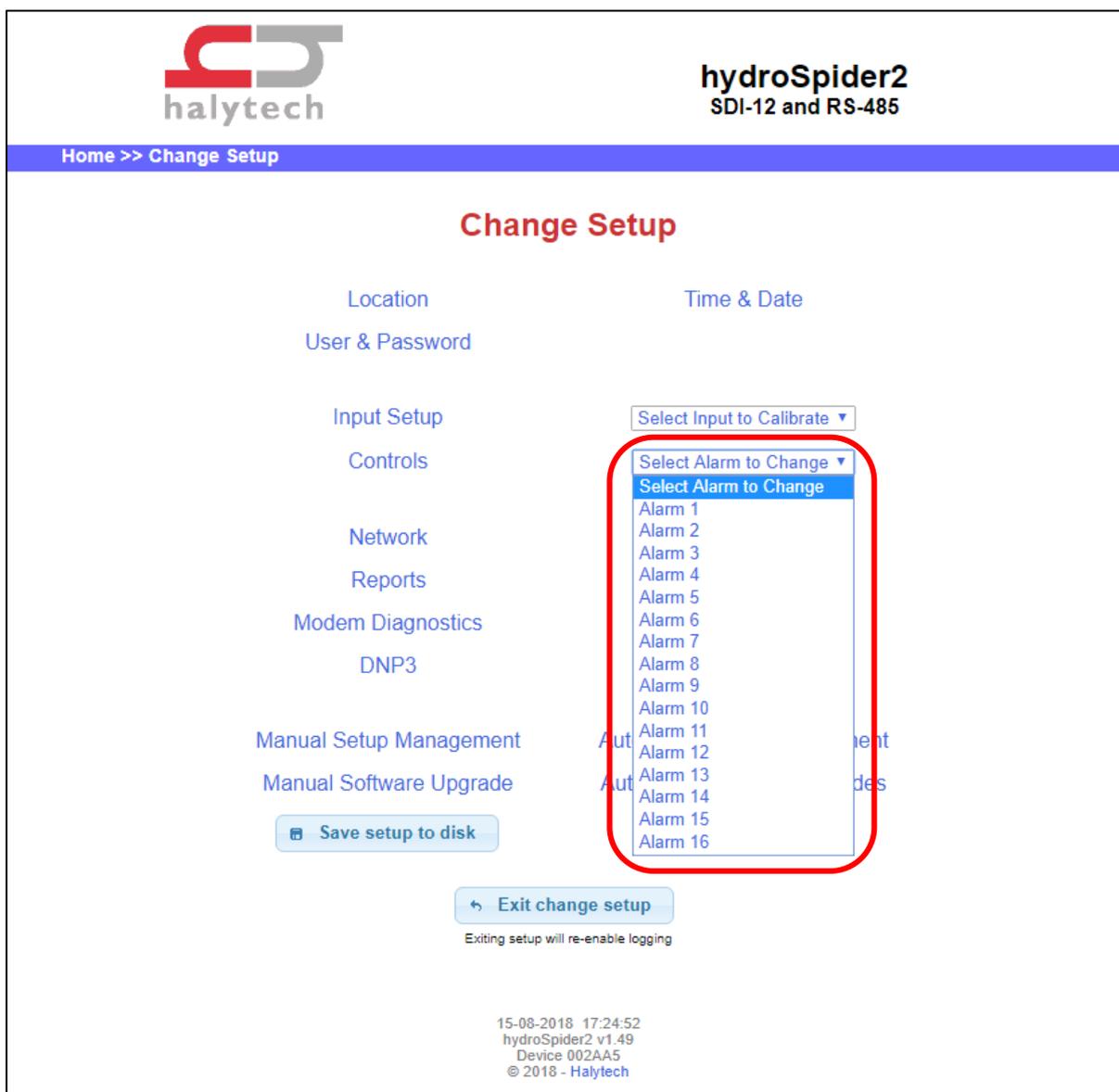
Twitter Account	
oAuth Token	<input type="text"/>
oAuth Token Secret	<input type="text"/>
Your Twitter oAuth details can be retrieved by going to halytech.com.au/twitter (requires internet access).	
<input type="button" value="x Cancel"/> <input type="button" value="✓ Save"/>	

5.10 Alarms

A hydroSpider2 can be configured with up to 16 alarms. Upon triggering, an alarm can perform the following:

- **Send alerts:** alarms can send out SMS messages, emails, and tweets. (see Appendix J - Alert Formats)
- **Send report(s):** alarms can send out reports over email, FTP and HTTP.
- **Turn controls on and off:** controls can be turned on, turned off, or pulsed.
- **Increment or reset a counter:** the number of times an alarm is triggered can be counted.
- **Log a channel:** an additional input can be logged whenever an alarm is triggered.
- **Change the logging rate:** the hydroSpider2 can log faster for the duration of an alarm.

Alarms can be configured by selecting an alarm slot from the dropdown on the *Change Setup* page, shown below:



Once an alarm has been selected from the dropdown, you will be redirected to the *Change Alarm* page. A snippet of the *Change Alarm* page is shown below.

Change Alarm 'Low Water'

Alarm name

Trigger source

Trigger level

Qualifying time second(s)

Alarm Actions

Control action

Counter action

Log action Log additional channel

Channel to log

Perform actions

Send alarm report

Fast logging

Stop fast logging when

Message

Auto acknowledge time minute(s)

SMS Alerts

1st phone number

2nd phone number

3rd phone number

Email Alerts

Twitter Alerts

5.10.1 Alarm options

Each alarm has a variety of options for configuring its behaviour. These options are described below.

- **Alarm name:** the textual name associated with this alarm. The alarm name will be used to identify alarms in the webpages and any alerts.
- **Trigger source:** the trigger source is the data which is being monitored by the alarm. When this data meets the set condition(s), the alarm will go active. Available trigger sources include channel values, the time/date, and even the state of other alarms via a *Super Alarm* trigger source, which will be further discussed later.
- **Trigger level:** see 5.10.4 - Trigger Sources.
- **Qualifying time:** see 5.10.4 - Trigger Sources.

- **Send report:** see Alarm Report Options, below.
- **Fast logging:** alarms have the ability to influence the hydroSpider's logging period when they activate. See 5.10.8 - Advanced - Fast logging.
Stop fast logging when: determines when the alarm should stop influencing the hydroSpider's logging rate. It can happen either when the alarm condition goes inactive, or when the alarm is acknowledged (see 5.10.5 - Alarm Acknowledgement).
- **Message:** this text will be present in alerts sent by this alarm.
- **Auto acknowledge time:** the amount of time after being triggered which the alarm should be automatically acknowledged (see 5.10.5 - Alarm Acknowledgement).

5.10.2 Alarm Actions

Each alarm can initiate a number of actions:

- **Control action:** see 5.10.7 - Alarm control activation and deactivation.

Alarms can optionally affect the selected control:

- **Continuously:** simply turns the control **on** or **off**. The control will remain in that state until it's changed manually, or by another alarm.
- **Pulse:** turns the control **on** or **off** for a period of 1 to 999 seconds when the alarm goes active.
- **Counter action:** Alarms can increment a virtual counter, or reset any counter, making it possible to count external events, such as the number times an input threshold is exceeded.

This facility is especially useful when combined with *Super Alarms*. For example, an alarm could activate a water sampler and increment a counter whenever a defined event occurs, until a maximum sample count is reached.

The following actions can be performed on the specified counter or event channel whenever the alarm is triggered:

- **Increment:** increment a virtual counter by one (only available for channels with Source = **Virtual**).
- **Reset:** reset a Counter or Event channel to zero.
- **Log action:** This option makes it possible to log another channel whenever the alarm is triggered. This is useful if, whenever one input triggers an alarm, you want a snapshot of another input's reading at that point in time.

Channel to log: The additional input channel to log whenever this alarm is triggered.

- **Perform actions:** This option specifies under what conditions the above actions will be performed:
 - **Once until alarm reactivated:** The actions will be performed whenever the alarm is activated, regardless of whether it has been acknowledged.

Note that the alarm must go inactive and then active before the alarm actions will occur again.

- **Once until alarm acknowledged and reactivated:** The actions will be performed when the alarm is first activated, and will not be performed again until the alarm has been acknowledged.

Note that the alarm must also go inactive and then active before the alarm actions will occur again.

This can be used to limit how often the control activates.

See 5.10.7 - Alarm control activation and deactivation for an example.

- **On each log while alarm is active:** The actions will be performed whenever the alarm's source channel is logged (or for a super alarm, whenever any of the inputs which are monitored by the super alarm are logged), while the alarm is active. This continues as long as the alarm remains active, regardless of whether it has been acknowledged.

This can be used to continually perform an action while a condition remains true, the rate being set by the source channel's logging period.

For example, a counter could be incremented every minute while a water level stays above some threshold, and this counter could then trigger another alarm to send an alert that the water level was high for too long.

5.10.3 Alarm Alerts

Each alarm also has a number of alerting options, when open when the checkbox in each is selected. The alarm will then send the selected alert(s) when it triggers:

- **SMS Alerts**
 - **Phone numbers:** up to 3 phone numbers can be specified. Alerts will be sent to these 3 phone numbers in the order listed. Only digits should be entered into this field (so no spaces or brackets), and any unrequired phone number slots should be left blank.
- **Email Alerts**
 - **Email addresses:** up to 3 email addresses can be specified. Alerts will be sent to these 3 email addresses simultaneously. Any unrequired email address slots should be left blank.
- **Twitter Alerts**
 - Alerts will be tweeted to the Twitter account (configured in the *Change Twitter Settings* page)

If an alert fails for any reason (low signal strength and network congestion are the two most common causes), it will be retried. Each SMS number is retried 3 times at an interval of 1 minute before moving to the next phone number in the list; email alerts are retried 3 times at an interval of 3 minutes; and twitter alerts are retried 3 times at an interval of 3 minutes.

5.10.3.1 Alarm Report Options

Alarms can be configured to send one or more reports when triggered.

The following "Send alarm report" options are available:

- **Disabled:** don't send any alarm reports

- **Once only:** a single report will be sent, containing data logged up until the point when the alarm occurred. This is useful for seeing what conditions led up the alarm.

By default, the report includes the entire last day (1440 minutes) of logged data, but you can limit this (saving battery usage and mobile data allowance) by specifying how many minutes to report in the “First report to include the last” field.

Note that this many minutes of data will be included in the alarm report, even if another report containing some of the same data has already been sent.

- **Two Times:** two reports will be sent.

The first report is exactly the same as for a “Once only” report, containing data leading up to the alarm for the specified period (1 day by default).

A followup report is then sent some minutes (specified by “Followup report delay”) after the alarm is triggered. This second report only contains data logged since the alarm occurred. This allows the user to see what happened for a window of time after the alarm was triggered, without needing to wait for the next periodic/daily report.

- **Repeat (fast reporting):** a series of reports will be sent.

Again, the first report is exactly the same as for a “Once only” report, containing data leading up to the alarm for the specified period (1 day by default).

Followup reports are then sent at the rate specified by the “Fast Report Period” specified on the *Change Report Settings* page (see below). Each of these reports only contains data logged since the previous alarm report was sent.

Fast reporting continues until the alarm goes inactive or has been acknowledged, selectable by the “Stop fast reporting when” dropdown.

Fast reporting allows the user to receive regular updates while an alarm condition is active, so that the situation can be monitored as it unfolds.

NOTE: Fast reporting is completely independent of fast logging. Either can be enabled without the other. However, for the followup reports to include useful data, the logging period must be less than or equal to the fast report period, so in practice it will usually make sense to enable fast logging whenever fast reporting is used.

The alarm report format is configured in the Alarm Reports section in the *Change Report Settings* page (see 5.11 - Reports):

Alarm Reports	
Reports to send	<input checked="" type="checkbox"/> Email <input type="checkbox"/> FTP 1 <input type="checkbox"/> FTP 2 <input type="checkbox"/> HTTP
Email subject	<input type="text"/>
Fast Report Period	<input type="text" value="15 minutes"/>
Format	<input type="text" value="Raw"/>
Time order	<input type="text" value="Decreasing"/>

The alarm report options are:

- **Reports to send:** Whether alarm reports will be sent to the list of email addresses, either of the FTP servers and/or the HTTP server (specified on the *Change Report Settings* page)
- **Email Subject:** This will appear as the subject of emails containing the alarm report
- **Fast Report Period:** How often repeat alarm reports should be sent out (only applies to alarms with “fast reporting” enabled – see above)

- **Format:** The format in which alarm reports are sent. See Appendix I - Report Formats
- **Time order:** Select increasing to have the records in the alarm report ordered from oldest to newest; or decreasing to have the records ordered from newest to oldest.

5.10.4 Trigger Sources

As mentioned earlier, alarms have a variety of different sources available which can be used to trigger alarms. The available trigger sources are covered in the following sections.

5.10.4.1 Channels

Any configured channel can be used as an alarm trigger source.

Trigger source	Digital 1: Switch
Trigger when	On
Qualifying time	0 second(s)

Switch channel as a trigger source

Trigger source	Analogue 4: Water Level
Trigger level	Below 5.000
Qualifying time	0 second(s)

Analogue channel as a trigger source

Selecting a channel as a trigger source presents the following additional options:

- **Trigger when:** This applies to switch inputs only, and specifies whether the alarm should activate when the switch is off (open) or on (closed)
- **Trigger level:** This determines at what channel value the alarm should go active. There are a number of different types of trigger level which become available depending on the channel selected as the trigger source:
 - **Above:** Active when the channel value is above the specified value
 - **Below:** Active when the channel value is below the specified value
 - **Change of:** Active when the channel value has changed by at least the specified value in the specified amount of time.
 - **Rising or falling:** The alarm will trigger if the channel value is either rising or falling
 - **Rising:** The alarm will only trigger on a rising value
 - **Falling:** The alarm will only trigger on a falling value
 - **Event:** Active when any event (change in value) occurs on an event channel. Note that the event trigger type is only applicable to event inputs, and cannot be selected if periodic reset has been enabled for this channel.

- **Qualifying time:** Determines how long the trigger condition must remain active before the alarm is activated.

For example, if an alarm should only activate if a switch is in the ON state for over 30 seconds, the alarm can be set up with a qualifying time of 30. If the switch goes ON and then back off 15 seconds later, this alarm won't trigger because the qualifying time of 30 seconds had not yet elapsed.

When used with an event trigger, the qualifying time specifies how long after the event occurs that the alarm will be activated. This makes it possible to delay an action, such as operating a control, which is triggered by an event.

5.10.4.2 Date / Time

Alarms can be triggered at particular dates and times by selecting the Date / Time trigger source. Once selected, you will be presented with a number of additional options. A screenshot of these options is shown below.

The screenshot shows the configuration interface for a Date/Time alarm. At the top, the 'Trigger source' is set to 'Date / Time' and the 'Trigger time' is set to '00:00'. Below this, a section titled 'Choose when this alarm should trigger' contains a 'Load editable preset' dropdown menu set to 'Weekly (Every Monday)'. Underneath are three selection boxes: 'Months of the Year' (with all months from Jan to Dec selected), 'Days of the Month' (with all days from 1 to 31 selected), and 'Days of the Week' (with 'Mo' selected). A note below these boxes states 'Note: alarm will trigger only if all three conditions are met.' At the bottom, the 'Remain active for' field is set to '0' seconds.

Date / Time alarm set up for weekly alarming

The newly available options for Date/Time alarms are:

- **Trigger Time:** The time at which the alarm should go active.
- **Remain Active For:** How long (in seconds) the alarm should stay active for after it triggers.
- **Months of the Year:** The months of the year (January-December) when the alarm is allowed to activate.
- **Days of the Month:** The days of the month (1-31) when the alarm is allowed to activate.
- **Days of the Week:** The days of the week (Monday-Sunday) when the alarm is allowed to activate.

Note that the Month of the Year, Day of the Month, and Day of the Week must all be met for the alarm to activate. The example shown above is a weekly alarm occurring on Monday at 00:00.

5.10.4.3 Periodic

Alarms can be triggered at regular intervals by selecting the Periodic trigger source.

Trigger source	<input type="text" value="Periodic"/>
Period	<input type="text" value="15 minutes"/>
Offset	<input type="text" value="0"/> hours <input type="text" value="0"/> minutes <input type="text" value="0"/> seconds
Remain active for	<input type="text" value="0"/> second(s)

Once selected, you will be presented with a number of additional options:

- **Period:** How often the alarm trigger.
- **Offset:** Choose a delay to add to the alarm triggering time.
For example, if you want to perform an action at 20 minutes past each hour, set the period to 1 hour and the offset to 20 minutes.
- **Remain Active For:** How long (in seconds) the alarm should stay active for after it triggers.

Note that periodic alarms can be combined with Date / Time alarms by using a Super Alarm (see below), to perform a periodic action only on specific days and/or between certain hours of the day.

5.10.4.4 Super Alarms

The state of two or more alarms (whether they are active or inactive) can be used as a trigger condition in what is known as a Super Alarm. This kind of alarm monitors the state of the selected alarms and, if they line up with what the user has configured, the alarm will activate.

The various alarm conditions can be combined using 'AND', where every condition must be met before the super alarm will trigger, or 'OR', where if any of the alarm conditions are met, the super alarm will be triggered.

This is useful for creating complex alarm trigger conditions.

The screenshot shows a configuration window for a Super Alarm. At the top, 'Trigger source' is set to 'Super Alarm'. The main area is titled 'Choose from Alarms 1 - 3 Alarm Triggers When'. It contains three rows of conditions, each with a 'remove' button:

- Flow > 1L/min (ACTIVE)
- Pump ON (INACTIVE)
- Water > 3m (ACTIVE)

An 'AND' operator is selected between the conditions. There is an 'add alarm' button. At the bottom, 'Qualifying time' is set to 0 seconds.

Super Alarm trigger source

For example: take the scenario where the hydroSpider2 has been configured with the following channels:

- Channel 1: Incoming flow (Counter)
- Channel 2: Pump state (Switch)
- Channel 3: Water level (Analogue)

The user wants the hydroSpider2 to send out an alert only when the incoming flow is greater than 1L/minute AND the water level is greater than 3m AND the pump state is OFF.

To achieve this, the following alarms can be set up:

- Alarm 1: Channel 1 (Incoming flow) > 1.000 L/min
- Alarm 2: Channel 2 (Pump state) is ON
- Alarm 3: Channel 3 (Water level) > 3m
- Alarm 4: Super Alarm [alarm 1 active AND alarm 2 inactive AND alarm 3 active]
 - Configured to send out an alert

5.10.5 Alarm Acknowledgement

Alarms have two basic *activation states*: active and inactive. An alarm is active when its alarm condition is met, and is inactive when the alarm condition is not met.

In addition to its activation state, alarms also track whether they have been *acknowledged* since their last activation. Acknowledging an alarm basically indicates that this instance of alarm activation has been handled and that you now wish to receive alerts for future activations.

Alarms can be acknowledged a number of ways:

- **Web interface:** the user can access the hydroSpider with a browser, go to the *Alarms* page, and click on the alarm they wish to acknowledge. See 4.3 - Alarms: Status of Current Alarms.
- **Auto Acknowledgement:** the hydroSpider can automatically acknowledge the alarm after an amount of time. Using auto acknowledgement effectively means that an alarm will send out alerts/reports at most once per auto acknowledgement period.

5.10.6 Alarm Triggering

Triggering refers to the alarm sending out its alerts and reports. Both the activation state and the acknowledgement state are used to determine whether an alarm will *trigger* and send its alerts/reports. After an alarm triggers, the alarm will not re-trigger until both of the following have occurred (in any order):

- The alarm has been acknowledged AND
- The alarm goes inactive and then active again

This means that an alarm can go active an inactive numerous times, but new alerts/reports will not be sent until that alarm is acknowledged. This is important because it prevents the alarm from sending out spurious alerts and reports in the event that its activation state is fluctuating meaninglessly (eg: the case of a float switch tripping continuously due to tiny changes in water level around its desired level).

5.10.7 Alarm control activation and deactivation

Alarms can be used to control external systems by assigning them a *control action* such as turning *Switched Power Out* on or off.

The control action is usually performed whenever the alarm enters the active state, regardless of whether it has been acknowledged, unless the "Once until alarm acknowledged and reactivated" option has been selected – see the second example below.

As an example, take the scenario where the water level in a tank needs to be maintained at a particular level. This can be achieved by setting up the hydroSpider to monitor the tank's water level, and then setting up two alarms:

- Alarm 1: this alarm's job is to turn on the pump when the water level gets too low.
To achieve this, the alarm is configured to activate when the water level falls below the tank's low level, and is assigned a control action (eg: Switched Power Out ON Continuously) which is wired to trigger the pump to turn on.
- Alarm 2: this alarm's job is to turn off the pump when the water level gets too high.
To achieve this, the alarm is configured to activate when the water level rises above the tank's high level, and is assigned a control action (eg: Switched Power OFF Continuously) which is wired to trigger the pump to turn off.

In that example, the pump (and therefore the control) should operate whenever the water level is too low, whether or not the alarm has been acknowledged. There is no need to limit how often the pump should run, and no need to wait for human intervention – the control action should be fully automatic.

However, in some situations it is important that a control action occur only once or no more than every so often.

Consider the situation where the control is wired to trigger a sampler. After an alarm (perhaps based on a temperature or salinity reading) triggers the control action, starting the sampling operation, no more samples can be taken until the sample has been removed. In that situation, the “Once until alarm acknowledged and reactivated” option should be selected to inhibit further control actions (samples) until this alarm has been acknowledged.

Or, perhaps a pump is to be operated for five minutes whenever an alarm is activated – but should not operate more than once per hour. In that case, the pump would be connected to a control, and the control action would be to pulse on for 300 seconds. To ensure that the pump only operates once per hour, the “Once until alarm acknowledged and reactivated” option should be selected, and the auto acknowledge time can be set to 60 minutes. When the alarm is triggered, the pump will operate for 5 minutes (300 seconds), but will not turn on again for 60 minutes, when the alarm is automatically acknowledged.

5.10.8 Advanced - Fast logging

When the fast logging option is enabled, any input channels with their logging period set to “General” will begin logging at the rate specified by “General fast logging period” on the *Change Input Setup* page when the alarm is triggered.

This is useful in many situations, including:

- If data is only required for a few hours a day. This can be achieved by configuring an alarm with the fast logging option in conjunction with a Time/Date trigger source (so that it goes active at the specified times).
- If faster rate data is required when an input is active. For example: normally logging water level data every 30 minutes until the level rises above a certain point, and then logging water level every 1 minute until the level falls again.

Conditional fast logging becomes even more important when the sensors are being powered from a battery source, since logging only when required can dramatically improve the system's battery life.

5.11 Reports

A report is a file that contains the data a hydroSpider2 has logged. The hydroSpider2 is capable of generating reports in a number of different formats, and reports can be retrieved from the hydroSpider in a few different ways:

- **Manually using the web interface:** The user can download part or all of the hydroSpider's logged data. See 4.6 - History: Download Logged Data.
- **Automatically:** A hydroSpider can be configured to automatically send out reports over email, FTP and/or HTTP on a periodic basis. This is useful for remote systems which can't be physically accessed to retrieve the logged data.
- **Alarms:** A hydroSpider can be configured to automatically send reports over email, FTP and/or HTTP whenever an alarm occurs. See 5.10.3.1 - Alarm Report Options.
- **Manually by requesting it with an SMS message:** a report can be triggered by sending the hydroSpider an SMS report request. This report can be sent over email.

The hydroSpider2 can be setup to automatically send up to two reports. Each report can be independently configured to periodically send logged data to up to two FTP servers (or two accounts on one server), three email recipients and/or an HTTP server.

Automatic reports can be set up from the Change Automatic Report Settings page of the hydroSpider. This page can be accessed by going into Change Setup and clicking the *Reports* link. A screenshot of this page³ is shown below:

Change Report Settings

<p>Automatic Report 1</p> <p>Send to: <input type="checkbox"/> Email <input type="checkbox"/> FTP 1 <input type="checkbox"/> FTP 2 <input type="checkbox"/> HTTP</p> <hr/> <p>Automatic Report 2</p> <p>Send to: <input type="checkbox"/> Email <input type="checkbox"/> FTP 1 <input type="checkbox"/> FTP 2 <input type="checkbox"/> HTTP</p> <hr/> <p>Alarm Reports</p> <p>Send to: <input type="checkbox"/> Email <input type="checkbox"/> FTP 1 <input type="checkbox"/> FTP 2 <input type="checkbox"/> HTTP</p> <hr/> <p>Reset Report Starting Point</p> <p>Click the button to prevent existing data from being included in the next automatic report.</p> <p><input type="button" value="Reset starting point"/></p>	<p>Email List</p> <p>Email 1: <input type="text"/></p> <p>Email 2: <input type="text"/></p> <p>Email 3: <input type="text"/></p> <hr/> <p>FTP Server 1</p> <p>Server: <input type="text"/></p> <p>Username: <input type="text"/></p> <p>Password: <input type="text"/></p> <p>Directory: <input type="text"/></p> <p><input type="button" value="Send Test File"/></p> <hr/> <p>FTP Server 2</p> <p>Server: <input type="text"/></p> <p>Username: <input type="text"/></p> <p>Password: <input type="text"/></p> <p>Directory: <input type="text"/></p> <p><input type="button" value="Send Test File"/></p> <hr/> <p>HTTP Server</p> <p>http:// <input type="text"/></p> <p><input type="button" value="Test HTTP POST"/></p>
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³ If your web browser window is narrow, the page will reformat into a single column, so may not appear exactly the same as shown here

This page gives a multitude of options for setting up automatic reports.

On the right are the available report destinations:

- **Email List**
 - **Email 1 - 3:** The hydroSpider2 allows up to 3 email addresses to be specified. The report is emailed to each of these addresses.
- **FTP Server 1 and FTP Server 2**
 - **Server:** Hostname or IP address of the FTP server which will have the report files uploaded to it.
 - **Username:** Username to access the FTP server
 - **Password:** Password to access the FTP server
 - **Directory:** The directory on the FTP server in which the hydroSpider should upload the report files.
 - **Test FTP Server:** Attempt to upload a test file to the specified FTP server. This is useful for checking that the FTP settings are correct and ensuring that your hydroSpider2 has write access to the nominated FTP directory.
- **HTTP Server**
 - **Server:** The report will be sent using HTTP to the specified URL, which should include the hostname or IP address of the HTTP server, the path to the page or script which will receive the report and (optionally) the server port number. If a port number is not specified, the default HTTP port (80) is used.

For example: host.example.com:8080/reports/upload.php where 'host.domain.com' is the HTTP server, '8080' is the port number and 'reports/upload.php' is the path.

Note that the leading "http://" is automatically added for you - you don't need to include it in the URL.
 - **Test HTTP POST:** Attempt to upload a test file via HTTP POST to the specified server. This is useful for checking that the unit can connect to the server with the current network settings and that the URL is correct.

Note that you only need to fill in the options that you will use. For example, you might have one FTP server and a couple of email addresses, or two FTP servers and one email address, or maybe just a single email address and no FTP or HTTP servers.

The first two sections on the left allow you to customise the behaviour of automatic reports. They open up when you click on one or more of the Email, FTP or HTTP checkboxes.

Automatic Report 1	
Send to	<input checked="" type="checkbox"/> Email <input checked="" type="checkbox"/> FTP 1 <input type="checkbox"/> FTP 2 <input type="checkbox"/> HTTP
Email subject	<input type="text" value="Automatic Report"/>
Period	<input type="text" value="1 day"/>
Send report	<input type="text" value="Always"/>
Offset	<input type="text" value="0"/> hours <input type="text" value="0"/> minutes <input type="text" value="0"/> seconds
Enable recovery	<input checked="" type="checkbox"/>
Format	<input type="text" value="Raw"/>
Time order	<input type="text" value="Decreasing"/>

The automatic report options are:

- **Reports to send:** Whether this report will be sent to the list of email addresses and/or either of the FTP servers and/or the HTTP server
- **Email Subject:** This will appear as the subject of emails containing the report
- **Period:** How often the automatic reports should be sent out
- **Send report:** This option is useful if you want to send reports only when new data is available. The options are:
 - **Always:** send the report every time it is scheduled, even if it contains no data
 - **Only when new data available:** send a report only if new data has been logged since the last report was sent
- **Offset:** Choose a delay to add to the report sending time. This is mainly useful in two situations:
 - When you want to send a daily report at a time other than midnight. E.g.: to send a report daily at 6:30am, set the period to 1 day and offset to 6 hours and 30 minutes.
 - When you want to include data that is logged slightly after a report is usually sent out. E.g.: SDI-12 channels take between 0.1s and 1s to respond. This means they won't be included in the report if it is sent exactly on the hour. Adding an offset of 10 seconds will ensure these late-running sensors are included in the report.
- **Enable recovery:** In the event that a daily report fails to send (e.g.: signal issues, network congestion, etc.), report recovery will cause any unsent data to be sent in the following days' daily report. This continues until the unit's log storage is full, after which the oldest data is abandoned in favour of newer data.
- **Format:** The format in which the reports are sent. See Appendix I - Report Formats.
- **Time order:** Select increasing to have the records in the report ordered from oldest to newest; or decreasing to have the records ordered from newest to oldest.

Note that the two Automatic Report sections are independent of each other. For example, you could setup report 1 to email a multi-column report daily at 8am, and also setup report 2 to send a raw report every 6 hours to an FTP server.

The next section, "Alarm Reports", is used to customise the reports (if any) to be sent when alarms occur. It is similar to Automatic Reports, but has some different options which are explained in 5.10.3.1 - Alarm Report Options.

One final option is **Reset Report Starting Point**. When this button is clicked, the hydroSpider resets its reports to start at that point in time. This is useful to prevent all of the data that was logged during the setup of the hydroSpider from appearing in the first daily and periodic reports.

5.12 Performing Modem Diagnostics

The Modem Diagnostics page is used to test the hydroSpider2's modem. It includes tests for modem signal strength and sending SMS messages.

To access the *Modem Diagnostics* page, click the *Modem Diagnostics* link from the *Change Setup* page. This will bring you to the following page:

Modem Diagnostics

Signal Strength Test

This test will turn the modem on and continue to display its signal strength until the test is closed.

[🔄 Mobile Signal Test](#)

SMS Test

This test sends an SMS containing this unit's location, serial number, current signal strength, and time.

Phone number

[🔄 Send Test SMS](#)

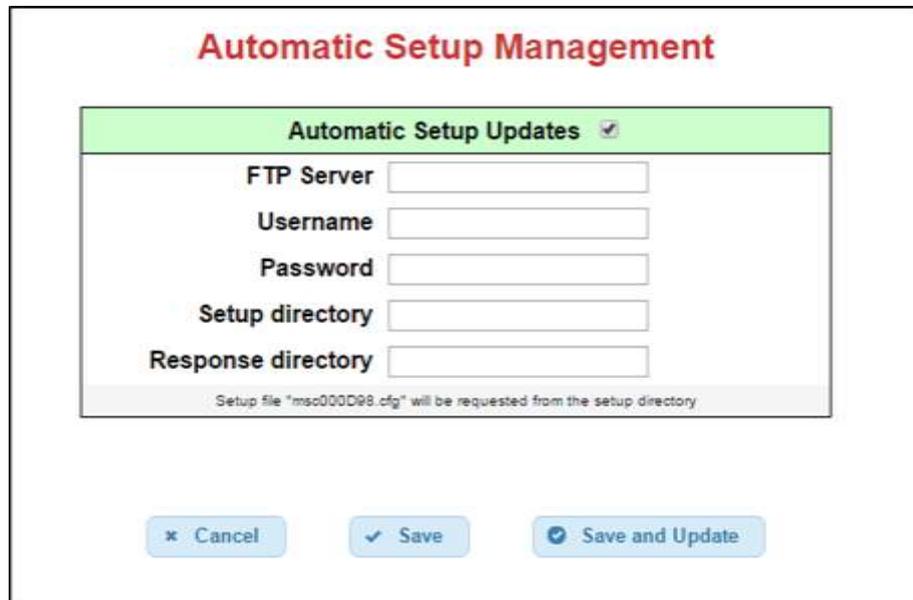
This page has two sections:

- **Signal Strength Test:** This test turns on the modem and reports the signal strength. This is useful to check that your SIM card is working and that the hydroSpider2/antenna is in a suitable location for reliable communications.
- **SMS Test:** This test attempts to send an SMS to the nominated mobile number. This SMS includes the hydroSpider's location name, serial number, signal strength, and date/time.

5.13 Automatic Setup Updates

The hydroSpider is capable of automatically updating its setup by downloading and installing configuration changes from an FTP server.

To set up automatic setup updates, click the *Automatic Setup Management* link from the *Change Setup* page. You will be presented with the *Automatic Setup Management* page, shown below:



The hydroSpider will request a uniquely-named software file from the FTP server. The name of the file is in the form:

mhc<serial number>.cfg

For example, if your hydroSpider's serial number is 00282C, the hydroSpider will request the file named *mhc00282C.cfg* from the FTP server.

Note that if multiple hydroSpiders are to be updated at the same time, you will need to have appropriately named separate setup files for each of them.

The following fields are available:

- **Automatic Setup Updates:** If set to enabled, the hydroSpider will check for new setup files daily after the daily report is sent out.
- **FTP Server:** The address of the FTP server which will be connected to when checking for setup updates.
- **Setup Username:** FTP server username.
- **Setup Password:** FTP server password.
- **Setup Directory:** The location within the server where the setup file will be stored for the hydroSpider to download.
- **Response Directory:** if the hydroSpider finds a new setup file, it will attempt to download and install it. On completion, a response file will be uploaded to the nominated response directory. This response file will indicate whether the hydroSpider was successful in installing the setup file, and will detail any errors it encountered if unsuccessful. If the response directory is left blank, the hydroSpider will upload response files to the chosen Setup Directory.

Note: Automatic setup updates will not be attempted if reporting is disabled.

At the bottom of the page, there is a *Save and Update* button which will save the current settings and attempt to do a setup update. This is useful to check if the entered settings are correct.

Refer to Appendix L - Setup file format for information about the format of the setup files.

5.14 Automatic Software Upgrades

Automatic software upgrades allow hydroSpider to download new software files from a remote server. This remote server can be either the Halytech Update Server, or your own self-managed FTP server:

- **Halytech Upgrade Server:** The Halytech Upgrade Server is easy to use. Every hydroSpider is able to update automatically from this server without any user intervention. When updating from the Halytech Upgrade Server, software updates will be managed by Halytech and will be available for your hydroSpider to download when we make them available to your unit.
- **Self-Managed FTP Server:** For users who wish to manage their own upgrades, the hydroSpider may be configured to upgrade directly from this FTP server. Upgrade files can be requested from Halytech which can be placed on your FTP server for the hydroSpider to pick up.

Each hydroSpider will request a uniquely-named file from the server. Software file names will be in the form: `msf<serial number>.hal`

Note that if you wish to manage upgrades of several units, you will need to have separate software files for each hydroSpider named according to each unit's serial number.

With automatic software upgrades enabled, the hydroSpider will check for new software after the daily report is sent out. If new software is found, the hydroSpider will download and install this software automatically and seamlessly.

To set up automatic software upgrades, click the *Automatic Software Upgrades* link from the *Change Setup* page. This will bring you to the *Automatic Software Upgrades* page, shown below:

Automatic Software Upgrades

Automatic Software Upgrades

Upgrade method Halytech Upgrade Server

Software will be requested from the Halytech Upgrade Server.

✕ Cancel
✓ Save
🔄 Save and Upgrade

The following options are available on this page:

- **Automatic Software Upgrades:** Enable or disable automatically checking for software upgrades.
- **Upgrade Method:** Either select the Halytech Upgrade Server, or select Self-Managed FTP Server.

If the upgrade method is selected as Self-Managed FTP Server, the following options will become available:

- **FTP Server:** hostname or IP of the FTP server which contains the upgrade files
- **Username:** username to log into the FTP server
- **Password:** password to log into the FTP server
- **Software directory:** the location within the server where the software upgrade files will be stored for the hydrospider2 to download
- **Response directory:** if the hydrospider2 finds a new software file, it will attempt to download and install it. On completion, a response file will be uploaded to the nominated response directory. This response file will indicate whether the hydrospider2 was successful in installing the software file, and will detail any errors it encountered if unsuccessful. If the response directory is left blank, the hydrospider2 will upload response files to the chosen Software directory.

Note: Automatic software upgrades will not be attempted if reporting is disabled.

At the bottom of the page, there is also a *Save and Upgrade* button which will save the current settings and attempt to do a software upgrade. This is useful to check if the entered settings are correct.

5.15 Manual Setup Management

The hydroSpider's *Manual Setup Management* page gives you some useful options for working with your hydroSpider's setup/configuration:

- **Save Setup to Disk:** The hydroSpider's entire setup can be downloaded to your computer. This file can later be loaded into other hydroSpiders or kept for reference.
- **Load Setup from Disk:** This allows you to load a saved configuration file from your computer into the hydroSpider. This will overwrite the hydroSpider's current settings with those in the loaded setup file.
Note: the setup file has to be from a unit with the same or earlier software version (e.g. a setup file from a unit running 1.43 software can be loaded into a device running 1.49, but not the other way around).
- **Email Setup:** The setup file can be sent via email to the entered address. Note that email and network settings will have to be set up for this to work.
- **Restore to Factory Defaults:** This option will set ALL of the hydroSpider's settings to the factory default values.

To access this page, click the *Manual Setup Management* link on the *Change Setup* page. This will bring you to the *Manual Setup Management* page, shown below:

Manual Setup Management

Save Setup to Disk

Save the setup file to your computer.

[Save setup to disk](#)

Load Setup from Disk

Load a previously saved setup file from your computer into this unit.

Select a file No file chosen

[Load setup from disk](#)

Email Setup

Email this unit's setup file to the entered email address.

Email address

[Email setup](#)

Restore to Factory Defaults

Restore this unit's setup to factory default values.

[Restore setup](#)

5.16 Manual Software Upgrade

The Manual Software Upgrade page is used to load in a software file manually using the web interface.

To access the *Manual Software Upgrade* page, click the *Manual Software Upgrade* link from the *Change Setup* page. This will bring you to the following page:



On this page, click the *Choose File* button and select the upgrade file you wish to load into the hydroSpider. Next, click the *Upgrade Now* button. The hydroSpider will now receive the file from your computer and attempt to install it.

There is currently no progress indicator on this page. After clicking the *Upgrade Now* button, the hydroSpider2 should remain on the *Manual Software Upgrade* page while its software is upgraded. It is recommended to simply wait for 5 minutes, and then re-access the web interface as if you were talking to a new unit.

5.17 Advanced Settings

The Advanced page provides various settings which change the default behaviour of the hydroSpider2. To access the *Change Advanced Settings* page, click the *Advanced* link from the *Change Setup* page. This will bring you to the following page:

Change Advanced Settings

Advanced Control Settings

When entering Change Setup Turn all controls off

Advanced Alarm Settings

Minimum auto ack time minutes (default = 60 minutes)

Modbus-485 Settings

Baud Rate

Parity

Stop Bits

Advanced Logging Settings

Store messages with channel data

- The **When Entering Change Setup** setting determines whether controls are turned off or not when setup is entered.

By default, all controls are turned to the 'Off' position when *Change Setup* is entered. Changing this option is useful if you want to keep the state of your controls while you browse the Change Setup pages.

- **Minimum Alarm Auto Ack Time:** By default, 60 minutes is the minimum value that an alarm's Auto Acknowledgement time can be set to. Changing this setting allows you to then set up alarms with auto acknowledgement times of as low as 5 minutes.

Lowering this setting is useful if you want the hydroSpider to send out more alerts on alarms triggering off fast-changing inputs.

See 5.10 - Alarms for more information on alarms and auto acknowledgement.

- **Store messages with channel data:** Diagnostic messages are stored in a separate area, to maximise the amount of channel data that can be stored. Channel data capacity can be further optimised by storing *information messages* in the separate diagnostics area.

Information messages are messages that the system stores to provide a log of its operation and actions, such as alarms, control activation, report progress, SMS interactions, calibration changes, software updates, etc.

By default, these messages are stored together with the logged channel data in the main storage area. This ensures that the record of actions such as alarms being activated and acknowledged, is retained for as long as possible, i.e. as long as any related data is retained.

If **Store messages with channel data** is deselected, the information messages will instead be stored with the diagnostic messages, in the smaller diagnostic log area. This will increase the number of channel data records that can be stored long term, but may result in fewer old diagnostic and information messages being retained.

Note: If you are using a SDI-12 / RS-485 hydroSpider, you will also see a Modbus-485 Settings section on this page – see Appendix A - SDI-12 / RS-485 for more information.

Note: If you are using a hydroSpider2 with the LiveSMS option enabled, you will also see a LiveSMS Settings section on this page – see Appendix E - LiveSMS (Software Option) for details.

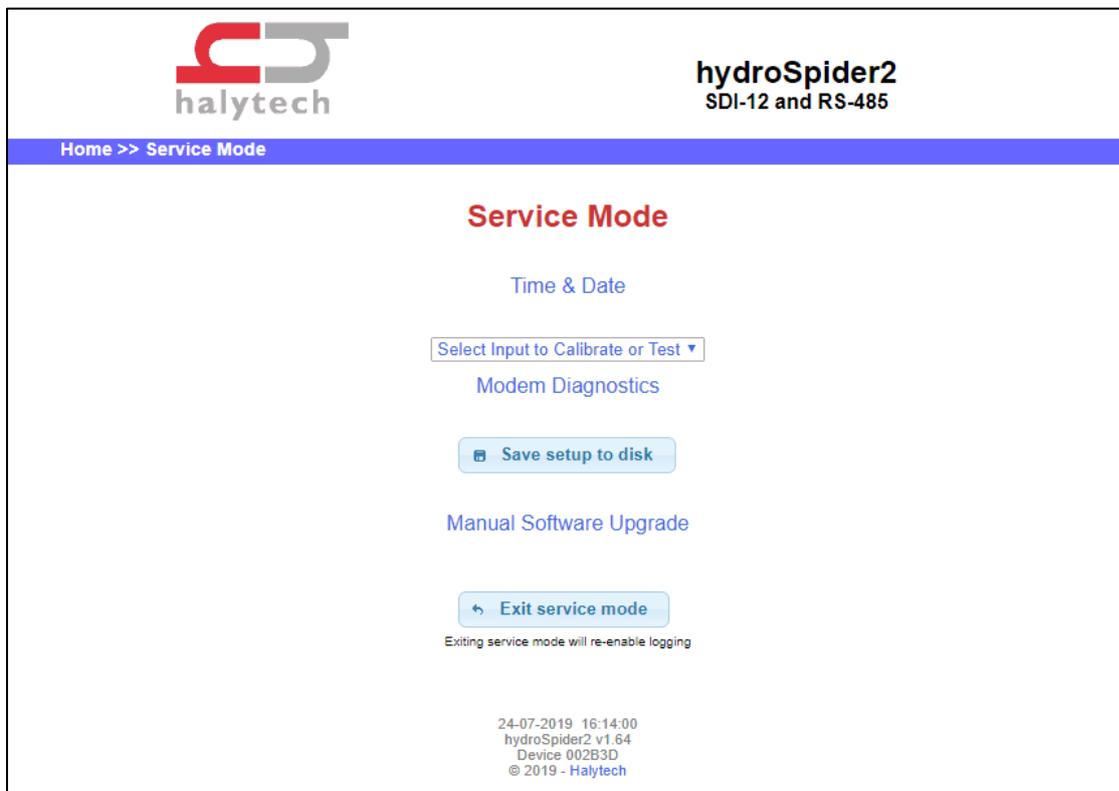
6 Service Mode

When a user logs in with the service account (default username of “service” and password of “changeme”), **Service Mode** becomes available instead of Change Setup:



The service mode is intended to allow field personnel perform diagnostic tests, recalibrate sensors and reset the unit’s time, without being granted access to change the unit’s setup.

After a warning that logging is disabled (to allow tests to be performed without affecting logged data), the Service Mode page appears:



The facilities available in service mode are described in the following sections.

6.1 Time and Date

The service account is able to set the hydroSpider2's time and date, as described in 5.2 - *Time and Date***Error! Reference source not found.**, but without the ability to change the NTP settings:

The screenshot displays the 'Change Time and Date' configuration page. At the top left is the Halytech logo, and at the top right is the device name 'hydroSpider2 SDI-12 and RS-485'. A blue breadcrumb trail reads 'Home >> Service Mode >> Time / Date'. A 'Help' button is located in the top right corner. The main heading is 'Change Time and Date'. Below this is a form with a green header 'Time and Date'. The form contains three rows of input fields: 'Current date' with values 16, 08, and 2018; 'Current time' with values 10, 53, and 53, followed by '(hh:mm:ss) - 24 Hour'; and 'Time zone' with a dropdown set to '+10' and a field set to '00', followed by '(Sydney is +10:00)'. A 'Set from computer' button is positioned below the time zone field. At the bottom of the form are 'Cancel' and 'Save' buttons.

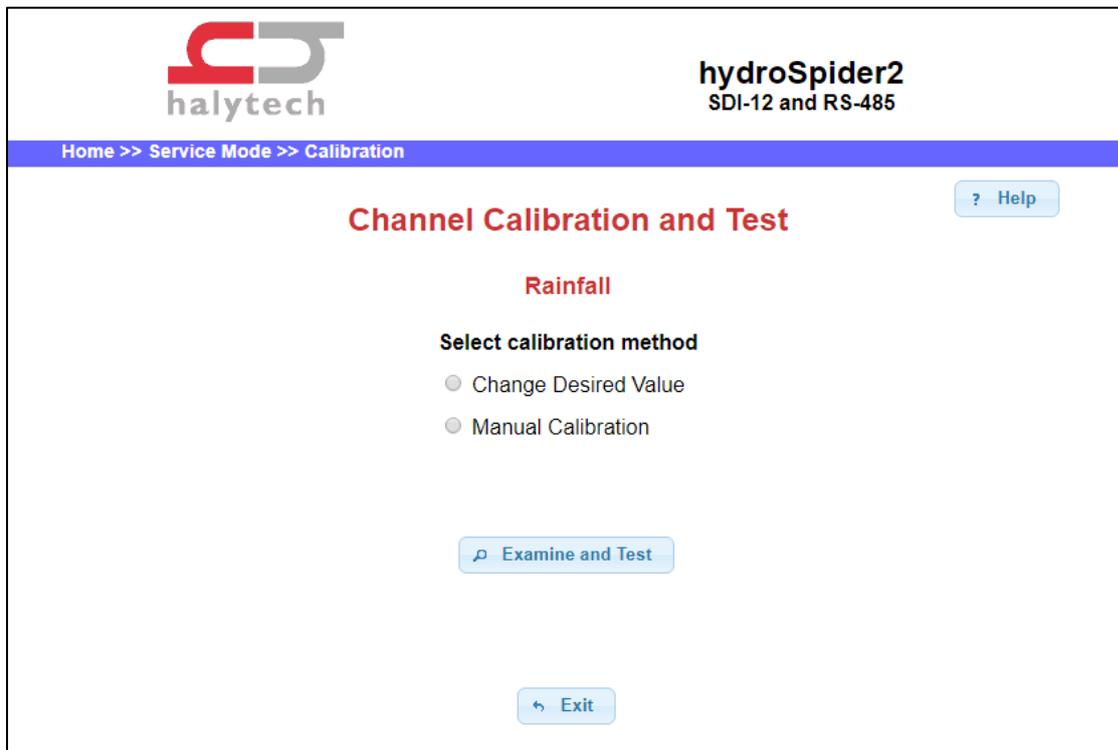
6.2 Modem Diagnostics

The Modem Diagnostics page is used to test the hydroSpider2's modem. It includes tests for modem signal strength and sending SMS messages, as described in 5.12 - *Performing Modem Diagnostics*:

The screenshot shows the 'Modem Diagnostics' page with a red heading. It contains two distinct test sections. The first section, 'Signal Strength Test', has a green header and a description: 'This test will turn the modem on and continue to display its signal strength until the test is closed.' Below the description is a 'Mobile Signal Test' button. The second section, 'SMS Test', also has a green header and a description: 'This test sends an SMS containing this unit's location, serial number, current signal strength, and time.' Below the description is a 'Phone number' label followed by an empty text input field, and a 'Send Test SMS' button.

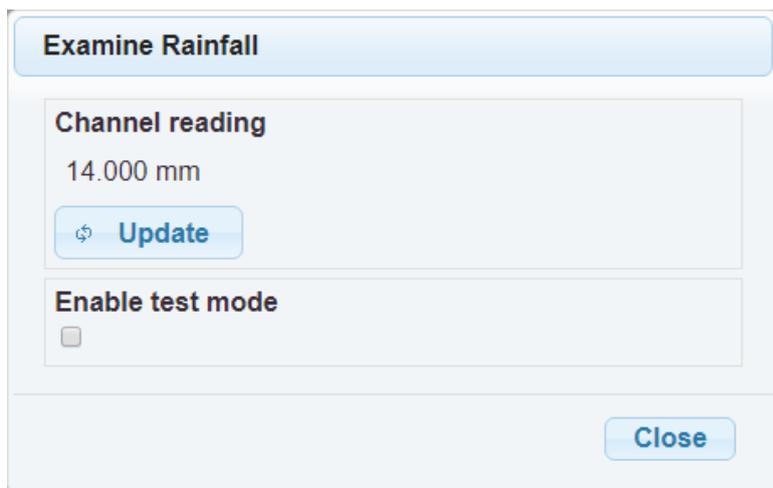
6.3 Input Channel Calibration and Test

Service mode allows inputs to be calibrated in exactly the same way as described in 5.6 - Input Channel Calibration, but adds an **Examine and Test** button:



The Examine and Test button allows the user to get real-time readings from the sensor, in the same way as the magnifying glass icon available in the *Change Input Setup* page.

However, for counter and event inputs, a test mode is also available:



Selecting **Enable test mode** resets the displayed reading to 0, without affecting any logged data. A known number of pulses can now be input (for example, a fixed amount of water poured into a rain gauge) and the reading updated to check that the expected quantity was read.

Disabling test mode restores the reading to the value it had before entering test mode – any test tips or pulses are discarded and are not logged.

6.4 Manual Software Upgrade

The service account is able to upgrade hydroSpider2's software, as described in 5.16 - Manual Software Upgrade. *Error! Reference source not found.*

The screenshot shows the 'Manual Software Upgrade' web interface. At the top left is the Halytech logo, and at the top right is the text 'hydroSpider2 SDI-12 and RS-485'. A blue navigation bar contains the breadcrumb 'Home >> Service Mode >> Manual Software Upgrades'. The main heading is 'Manual Software Upgrade' in red, with a '? Help' button to its right. A central box titled 'Load from Disk' contains a 'Select upgrade file' label, a 'Choose File' button, and the text 'No file chosen'. Below this is an 'Upgrade Now' button with a checkmark icon. At the bottom center is a 'Back' button with a left-pointing arrow icon.

Appendix A. SDI-12 / RS-485

This section applies to hydroSpiders that have been factory fitted with the SDI-12 / RS-485 option. This option removes the OC control and the native DIN2 and AIN2 channels, but adds the capability to monitor up to 16 inputs. These can be made up of any combination of up to 2 native inputs, 4 system inputs (Battery Voltage, Charger Voltage, System Temperature and Moisture Detector) and up to 16 intelligent SDI-12 / RS-485 inputs.

Appendix A1. Input Connections

The following table describes the pins of the hydroSpider's green I/O and Power connector. All pins are labelled on the lid of the hydroSpider.

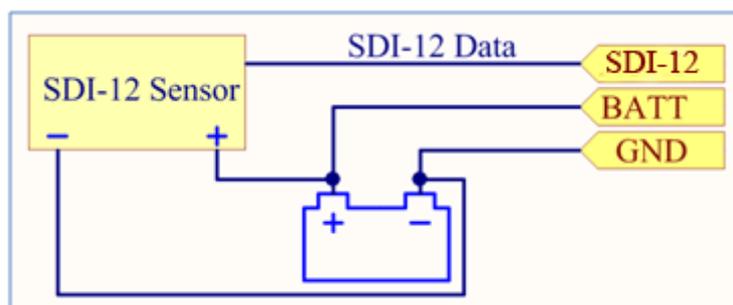
Label	Name	Function(s)	Comment
GND	GND	Ground	Common for all signals
AIN1	AIN1	Analogue 1 (Voltage 0 - 2.4V or Current 4-20mA)	User selectable
DIN1	DIN1	Switch 1 Counter 1	Active is short to ground
SDI-12	SDI-Data	SDI-12 Data	SDI-12 data wire
485 +	RS485 D+	RS485 Data +	RS-485 differential data wire
485 -	RS485 D-	RS485 Data -	RS-485 differential data wire
SWP	PWR OUT	Switched Power Out	Driven by control 1, max 1A
BATT	PWR IN	External Power In or Battery	Nominal 12V DC max 7.2Ah battery
CHG	CHARGER IN	Charger Supply In	15V – 24V 2A DC or 12V Solar Panel
GND	GND	Ground	Common for all signals

SDI-12 / RS-485 interface specific pins that are different from those on the standard hydroSpider are highlighted in yellow.

Appendix A2. Connecting Sensors

Both SDI-12 and RS-485 (Modbus) sensors can be daisy-chained to the hydroSpider's inputs. Each sensor needs to have a unique address so they can be talked to independently of the other sensors.

SDI-12 sensors must always be powered. The following diagram shows a suggested connection method for SDI-12 sensors.

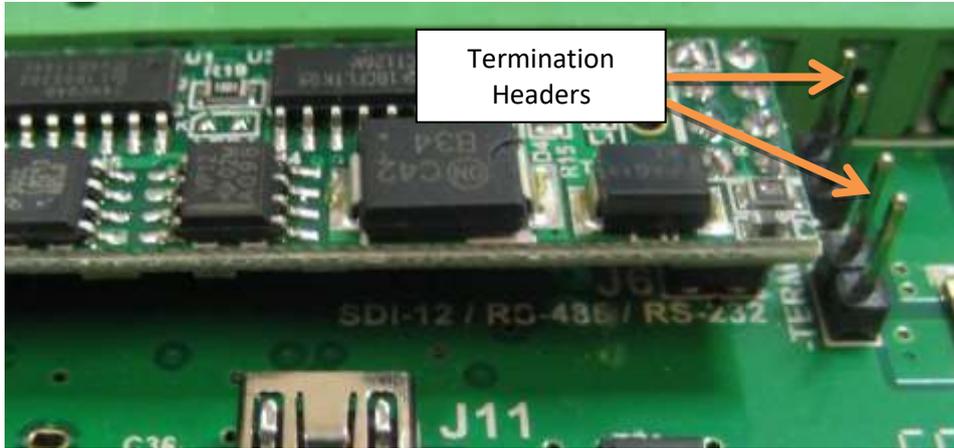


Additional sensors should all have a common ground connection, and can share the SDI-12 Data line by connecting in parallel.

Appendix A3. RS-485 Termination

RS-485 is designed to have biasing / termination resistors at either or both ends of the cable to improve noise immunity and reduce data corruption.

The hydroSpider has these resistors built in, however by default they are disabled. To enable the termination resistors, simply place a jumper on the pins shown in the diagram below.



Enabling these termination resistors may or may not be required depending on the sensor used.

The downside to enabling the termination resistors is an increase in current consumption which will negatively impact battery life.

Note: The termination resistors only apply to RS-485 and are not required if only using SDI-12.

Appendix A4. SDI-12 / RS-485 Inputs

SDI-12 / RS-485 hydroSpiders have a total of 16 input channels.

	Type	Source	Name	User ID	Units	Logging	
1	Analogue (Voltage)	Analogue 1	Water level	0	m	General	
2	SDI-12	Interface	Humidity	1	%	General	
3	Modbus-485	Interface	Temperature	2	C	General	
4	Disabled						
5	Disabled						
6	Disabled						
7	Disabled						
8	Disabled						
9	Disabled						
10	Disabled						

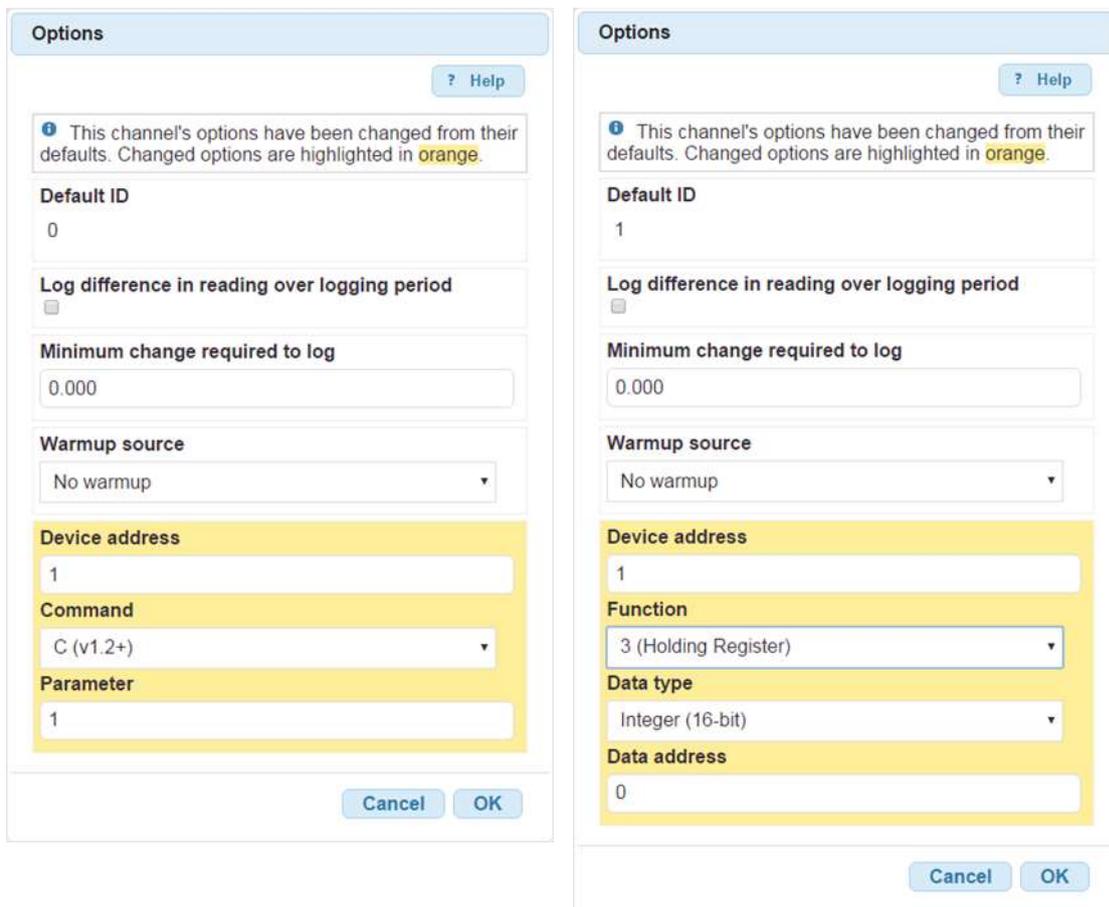
These 16 channels can be made up of any combination of up to 2 native inputs, 4 system inputs (Battery Voltage, Charger Voltage, System Temperature and Moisture Detector) and up to 16 intelligent SDI-12 / RS-485, as required.

SDI-12 and Modbus channels will query the sensors each logging period and log the values to the log file. Intelligent Sensors may be calibrated in a similar way to Analogue channels, and may be setup with "Minimum change required to log".

The hydroSpider will automatically determine the 'warm-up' times for SDI-12 sensors and will adjust its reading of the sensors to synchronize with the logging period. For instance, if a sensor is connected which takes 5 seconds to warm-up, the hydroSpider will ask this sensor to warm up 5 seconds before logging is due to occur so that it may log as close to the logging time as possible. With multiple sensors it may not be possible to synchronize all logs with the logging period; however they should be within several seconds.

Appendix A5. SDI-12 / Modbus-485 Options

The advanced options for the intelligent interface channels (SDI-12 / Modbus hydroSpiders only) can be seen below. (SDI-12 left, Modbus-485 right).



Refer to the sensor manufacturer's specifications in order to determine which settings to apply.

You may also test a sensor configuration from within the Change Input Setup page. Click on the examine icon (the "magnifying glass") to initiate a sensor read to ensure the channel is configured correctly before leaving the page.

SDI-12 Type Options:

Device Address: The address of the sensor, this may be numbers 0-9, letters a-z, and letters A-Z. As the device address is unique, each SDI-12 sensor connected to a single hydrospider2 requires a different device address.

Command: hydroSpider2 is fully compliant with SDI-12 v1.3 and will support the following commands: M, C, CC, R and RC. Which measurement command you choose to use depends on the specifications for the sensor, consult your sensor manufacturer / manual to determine which is best for you.

Parameter: When the hydroSpider2 retrieves the sensor values via SDI-12, the sensor may provide multiple values. The *Parameter* setting allows the user to choose which value the channel should log, these are numbered from 1.

For instance (assume M/C command has already been performed):

```
OD0!0+4.45+47.3847-38.3489<CR><LF>
```

Response Parameter 1 = +4.45

Response Parameter 2 = +47.3847

Response Parameter 3 = -38.3489

To determine which parameter you require, consult your sensor manual.

Modbus-485 Type Options:

Device Address: this may be any number between 1 and 255 inclusive. Since multiple Modbus devices can be connected to the Intelligent Interface at any one time, each Modbus device must be configured to have a unique address.

Function: the function code determines what sort of read to perform. This information should be listed in the sensor manual for each available register/coil.

Note: some manuals may list the function code in a format such as 40001. This is a convention left over from when Modbus was in its infancy. Values between 1 and 9999 indicate a function code of 1, values between 10001 and 19999 indicate a function code of 2, values between 30001 and 39999 indicate a function code of 4, and values between 40001 and 49999 indicate a function code of 3.

Data Type: the data type option specifies how the retrieved data value is going to be interpreted by the hydroSpider. The sensor manual should specify how the data from the sensor is encoded, and this option should be set to match that description. Some type options have two alternatives where one is LSW and MSW. LSW stands for Least Significant Word first and MSW stands for Most Significant Word first, however the sensor manual may refer to these under different names (eg: Little-Endian and Big-Endian, LSB and MSB). If it is not listed, it may be wise to use the Modbus diagnostic output to determine which data type should be used.

Data Address: this will be listed in the sensor manual for each piece of data that is available to be read from the sensor. It can be any number between 0 and 65535.

Note: some manuals may list the data addresses in hexadecimal format (eg: 0x03E8), in which case the address will need to be converted to a decimal number (0x03E8 -> 1000) before being entered into the Data Address option field

Note: Modbus data addressing in the hydrospider2 begins at 0 as per the Modbus protocol specification, however some manuals may start their addresses from 1. In this case 1 must be subtracted from the listed address. This is not always made obvious in the manual, so if the sensor is returning an exception, it is worth trying again with 1 subtracted from the data address

Note: some manuals may list the data addresses in a format such as 40001. This is a convention left over from when Modbus was in its infancy. To get the data address, remove the most significant digit (leaving 0001) and then subtracting 1 (resulting in 0000), which is the data address to enter into the hydroSpider.

Note: the *baud rate*, *parity* and *stop bits* settings of the Modbus-485 interface can be changed in 5.17 - Advanced Settings, although the default settings will work with most Modbus-485 sensors and you will not need to change them.

Appendix A6. SDI-12 Interactive Operation

If you require additional debugging, or want to change sensor parameters or the sensor address, the hydroSpider2 offers the SDI-12 Interactive Mode which allows the user to send any command to the sensor. You should consult your sensor user manual for a list of commands.

This is especially useful during installation and while debugging or configuring SDI-12 sensors.

You can enter the SDI-12 Interactive Mode by clicking on the input's examine icon (the "magnifying glass") in the Change Input Setup page, then typing commands into the **Interactive Command** field:

The image shows a software dialog box titled "Examine Channel". It is divided into two main sections. The top section, "Channel reading", displays "Updating..." and includes a blue "Update" button with a circular refresh icon. The bottom section, "Interactive Command", features a text input field and a blue "Send Command" button with a right-pointing arrow icon. A "Close" button is positioned at the bottom right of the dialog box.

Appendix A7. SDI-12 Command Control

The SDI-12 / RS-485 option adds an additional Control (see section 4.5 Controls), called SDI-12 Command, which sends a custom text string over SDI-12 when the SDI-12 Command Control is activated and/or deactivated.

This is used in situations where a sensor requires a custom command before or after a reading is taken. For example: a turbidity sensor may require a wipe command 20 seconds before a reading is taken. This can be achieved by using the SDI-12 Command control as a warmup on an SDI-12 turbidity sensor channel.

The SDI-12 Command control is configured on the Change Controls page:

The screenshot displays the 'Change Controls' interface for hydroSpider2 SDI-12 and RS-485. The page title is 'Change Controls' and it includes a 'Help' button. Two control configurations are shown:

- Switched Power Out:**
 - Custom name: Switched Power Out
 - Warmup time: 100ms
- SDI-12 Command:**
 - Custom name: SDI-12 Command
 - Warmup time: 100ms
 - On command: [Empty text box]
 - Off command: [Empty text box]

At the bottom, there are 'Cancel' and 'Save' buttons.

The SDI-12 Command control may be selected as a warmup for an input channel, in the same way as for Switched Power Out.

The “On command” string is sent over SDI-12 when the control activates, and the “Off command” is sent when the control deactivates.

If you have the LiveSMS software option (see Appendix E LiveSMS (Software Option)), the SDI-12 Command control is referenced as ‘CN4’. For example, the SMS command “ON CN4” will send the SDI-12 On command.

If you have the DNP3 software option (see Appendix G), the SDI-12 Command control can be accessed as DNP3 binary output point 3.

Appendix B. RS-232 / Serial

This section applies to hydroSpider units that have been factory fitted with the RS-232 / Serial interface option.

This option removes the OC control and the native DIN2 and AIN2 channels, but adds the capability to monitor up to 16 inputs. These can be made up of any combination of up to 2 native inputs, 4 system inputs (Battery Voltage, Charger Voltage, System Temperature and Moisture Detector and up to 16 intelligent RS-232 / serial inputs.

Appendix B1. Input Connections

The following table describes the pins of the hydroSpider's green I/O and Power connector. All pins are labelled on the lid of the hydroSpider.

Label	Name	Function(s)	Comment
GND	GND	Ground	Common for all signals
AIN1	AIN1	Analogue 1 (Voltage 0 - 2.4V or Current 4-20mA)	User selectable
DIN1	DIN1	Switch 1 Counter 1	Active is short to ground
TxD	TxD	Serial transmit data	Output
RTS	RTS	Serial RTS signal	Output
RxD	RxD	Serial receive data	Input
SWP	PWR OUT	Switched Power Out	Driven by control 1, max 1A
BATT	PWR IN	External Power In or Battery	Nominal 12V DC max 7.2Ah battery
CHG	CHARGER IN	Charger Supply In	15V – 24V 2A DC or 12V Solar Panel
GND	GND	Ground	Common for all signals

RS-232 / serial interface specific pins that are different from those on the standard hydroSpider are highlighted in yellow.

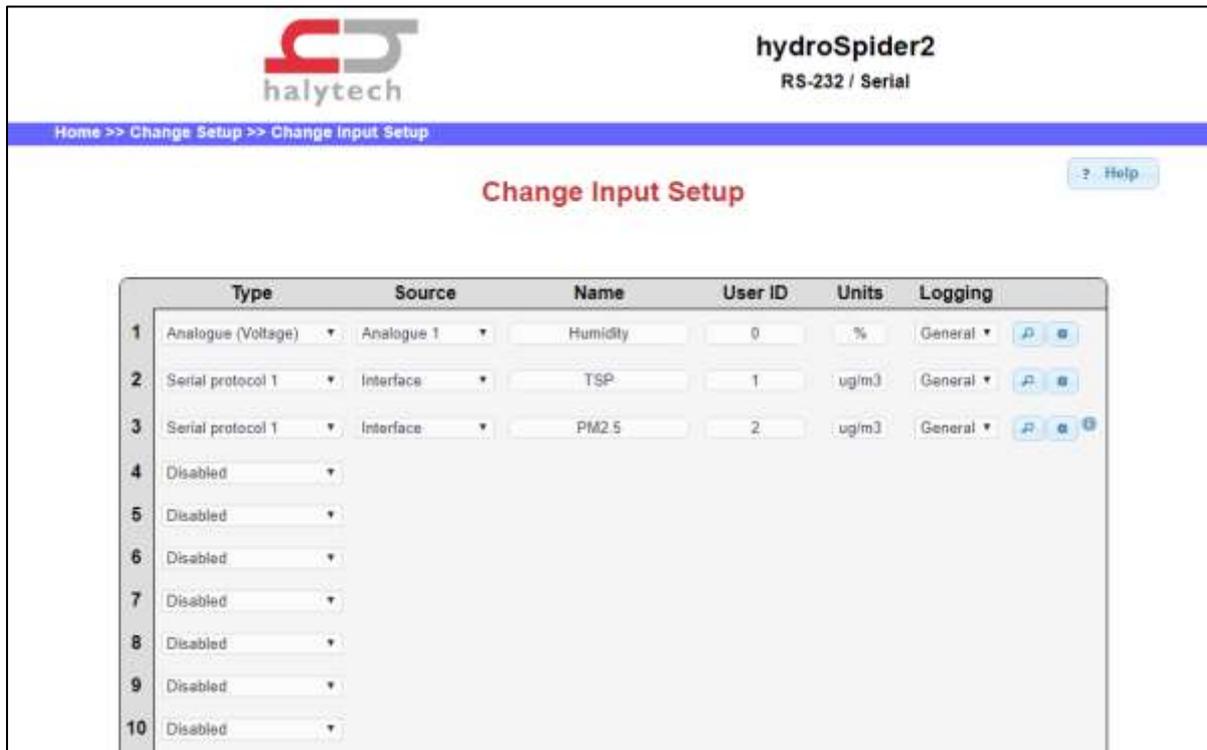
NOTE: The standard RS-232 interface is designed to operate only with industry-standard RS-232 signal levels.

Alternatively, Halytech can fit the hydrospider with a special serial interface, intended for use with 3.3V or 5V logic signals only (not true RS-232).

A label, placed next to the green I/O and Power connector, clearly identifies these units, which should not be used with standard RS-232 equipment.

Appendix B2. RS-232 / Serial Inputs

RS-232 / Serial hydroSpiders have a total of 16 input channels.



These 16 channels can be made up of any combination of up to 2 native inputs, 4 system inputs (Battery Voltage, Charger Voltage, System Temperature and Moisture) and up to 16 intelligent RS-232 / Serial inputs, as required.

RS-232 / Serial channels will query the sensors each log period and log the values to the log file. They may be calibrated in a similar way to Analogue channels, and may be setup with “Minimum change required to log”, “Log difference in reading over logging period”, and/or sampled more often than they are logged. And of course the logged values can be used to trigger alarms, in the usual way.

A supported serial protocol (see below) must be selected as the channel **Type**, and the **Source** will always be “Interface” for a sensor connected to the RS-232 / serial intelligent interface.

Appendix B3. Serial Protocol 1

This protocol is intended for use with dust sensors configured to provide the following readings:

Reading	Offset	Scaler	Units
TSP/Inhalable	-25.6	0.1	µg/m ³
PM10/Thoracic	-25.6	0.1	µg/m ³
PM2.5/Respirable	-2.56	0.01	µg/m ³
PM1/PM2	-2.56	0.01	µg/m ³
Temperature	-256	0.1	°C
Relative Humidity	-256	0.1	% RH
Wind Speed	0	0.1	Metres/sec
Wind Direction	0	1	Degrees

The advanced options for Serial protocol 1 channels are shown below.

Options

? Help

i This channel's options have been changed from their defaults. Changed options are highlighted in orange.

Default ID
4

Log difference in reading over logging period

Minimum change required to log
0.000

Warmup source
No warmup

Device address
2382

Reading
PM2.5/Respirable

Extract values from
LCD Memory

Sampling period
Same as logging

Cancel OK

Device Address: The 4-digit address of the sensor (numbers 0-9 only). This address is the same for all input channels which read data from this sensor. Changing the device address in one input channel will automatically update the address in the other input channels on the sensor.

Reading: The dust sensor returns eight types of readings, as shown in the table above. This setting allows you to choose, from the drop-down menu, which of these readings the channel should log.

Each reading will be automatically scaled to engineering units, e.g. $\mu\text{g}/\text{m}^3$. This is done by applying the scaling factors listed in the table above, as an input calibration, when the input is first setup. This calibration can be adjusted manually from the calibration setup page, if required.

Extract values from: Each reading can be extracted from either the sensor's LCD or Memory.

LCD readings are those currently shown on the sensor's display, averaged over the display refresh period (typically 10 seconds). These are the "current" readings, and can be averaged within the hydrospider by selecting a sampling period which is shorter than the logging period, for example sampling the input once per minute, but logging the channel every 10 minutes, to log a 10-minute average.

Memory readings are those most recently saved into the sensor's memory. These readings are averaged by the sensor, over a period of typically 10 minutes. When logging memory readings, the channel's sample and logging periods would normally be set to match the sensor's storage period.

When the sensor's memory is around 80% full, the hydrospider will command the sensor to clear its memory. This is necessary because the sensor will stop sampling if its memory is allowed to fill, and will happen approximately once per month for a 10 minute storage period. However, the next memory reading will not be available, because the memory has been cleared, and therefore will not be logged by the hydrospider.

Note that this issue only applies to memory readings, and does NOT affect LCD readings, which can always be logged by the hydrospider.

Appendix B4. FL900

This allows the hydrospider to communicate via Modbus over RS-232 with a FL900 data logger. It is typically used with Doppler radar flow sensors.

The advanced options for FL900 channels are shown below.

Options

? Help

i This channel's options have been changed from their defaults. Changed options are highlighted in orange.

Default ID
8

Log difference in reading over logging period

Minimum change required to log
0.000

Warmup source
No warmup

Device address
2

Data address
12

Test Sensor Configuration

Diagnostic Trace [+]

Cancel OK

Device Address: A number between 1 and 255 inclusive indicating the Modbus device address of the FL900 unit.

Data Address: This will be listed in the sensor manual for each reading that is available to be read from the sensor. It can be any number between 0 and 65535.

Note: some manuals may list the data addresses in hexadecimal format (eg: 0x03E8), in which case the address will need to be converted to a decimal number (0x03E8 -> 1000) before being entered into the Data Address field.

Note: Modbus data addressing begins at 0 as per the Modbus protocol specification, however some manuals begin their addresses from 1. In this case, 1 must be subtracted from the listed address. This is not always made obvious in the manual, so if the sensor is returning an exception, it is worth trying again with 1 subtracted from the data address.

Note: some manuals may list the data addresses in a format such as 40001. This is a convention left over from when Modbus was in its infancy. To get the data address, remove the most significant digit (leaving 0001) and then subtracting 1 (resulting in 0000), which is the data address to enter into the Data Address field.

Note: the RS-232 interface on the FL900 unit must be set to 19200 bps with even parity and one stop bit.

Appendix C. Alarm Status Codes

Appendix C1. SMS alerts

When an alarm is sending out SMS alerts, the status of the alerts is shown on the Alarms status page (see 4.3 - Alarms: Status of Current Alarms). The status codes have the following meanings:

Code	Meaning
1	1 st attempt to 1 st phone number
2	2 nd attempt to 1 st phone number
3	3 rd attempt to 1 st phone number
4	1 st attempt to 2 nd phone number
5	2 nd attempt to 2 nd phone number
6	3 rd attempt to 2 nd phone number
7	1 st attempt to 3 rd phone number
8	2 nd attempt to 3 rd phone number
9	3 rd attempt to 3 rd phone number
10	The hydroSpider has attempted to send SMS alerts to all phone numbers. The alarm has not been acknowledged and no further send attempts are going to be made.

Appendix C2. Email alerts

When an alarm is sending out email alerts, the status of the alerts is shown on the Alarms status page (see 4.3 - Alarms: Status of Current Alarms). The status codes have the following meanings:

Code	Meaning
1	1 st attempt in sending all 3 emails
2	2 nd attempt in sending all 3 emails
3	3 rd attempt in sending all 3 emails
4	Email transmission succeeded or all attempts exhausted. No more send attempts are being made.

Appendix C3. Twitter alerts

When an alarm is sending out a twitter alert, the status of the alert is shown on the Alarms status page (see 4.3 - Alarms: Status of Current Alarms). The status codes have the following meanings:

Code	Meaning
1	1 st attempt in sending the twitter alert
2	2 nd attempt in sending the twitter alert
3	3 rd attempt in sending the twitter alert
4	Twitter transmission has succeeded or all attempts exhausted. No more send attempts are being made.

Appendix D. SMS Commands

Each SMS message sent to the hydroSpider must begin with the hydroSpider's serial number. The hydroSpider will reject the SMS message if this serial number is incorrect, and will not respond to the SMS message.

The hydroSpider's serial number can be obtained by reading the label on the enclosure (see 2.1 - Labels), the Log In page (see 4.2 - Logging in), or by looking on the *About* page (see 4.9 - About).

After the serial number, you may send one or more commands. The format for SMS commands is as follows:

`<command>=<value>`

Multiple commands may be sent in a single SMS by separating them from one another using a space.

For example: to send the getrep command to a unit with serial number 002716, the following SMS message would be sent to the unit's mobile number:

002716 getrep='reports@halytech.com.au'

For example: to send the getrep and getrepfmt commands to a unit with serial number 002716, the following SMS message would be sent to the unit's mobile number:

002716 getrep='reports@halytech.com.au' getrepfmt='d'

Note: Generally the order of commands does not matter, but the serial number must be the first item in the message.

Note: You cannot spread a single set of commands over multiple SMS messages. If more than 160 characters are sent in one SMS message, the hydroSpider will reject the entire message. You may send the hydroSpider multiple SMS messages at a time, but be aware that each must begin with the hydroSpider's serial number, and the order in which multiple SMS messages are received / processed is not guaranteed.

Note: You should not include any '\ ' (backslash) characters in your SMS messages, as they will be received by the hydrospider2 as a ' / ' (space followed by forward slash).

Note: Only the settings which are sent in the SMS message are changed. All other settings remain unchanged.

Note: in all examples the serial number is shown as 002716. You need to replace this with your hydroSpider's own serial number.

Appendix D1. Requests for data

Command	Description
getrep	<p>Get a report. This sends everything from the last daily report forwards. Specify email address. For example:</p> <pre>002716 getrep='joeblogs@halytech.com.au'</pre> <p>The report will be in the same format used for automatic reports unless otherwise specified by using the <i>getrepfmt</i> command.</p>
getrepN	<p>Get a report that contains data starting from N days ago. N may be any number from 0 to 30 where 30 will make the report begin with records from 30 days ago. For example:</p> <pre>002716 getrep30='reports@halytech.com.au'</pre> <p>The report will be in the same format used for automatic reports unless otherwise specified by using the <i>getrepfmt</i> command.</p>
getrepd	<p>Get a report that contains data from a specific date, in the format "dd/mm/yy". For example:</p> <pre>002716 getrepd='01/08/16 reports@halytech.com.au'</pre> <p>to send all data recorded on 1 August 2016. An end date may also be specified, for example:</p> <pre>002716 getrepd='01/08/16-30/09/16 reports@halytech.com.au'</pre> <p>to send all data from August and September 2016. The report will be in the same format used for automatic reports unless otherwise specified by using the <i>getrepfmt</i> command.</p>
getrepfmt	<p>Specify the format of the requested report (r for Raw, f for Filtered, d for Diagnostic, m for Multi-Column, u for User-ID). This must be used in conjunction with the getrep command. For example:</p> <pre>002716 getrep='reports@halytech.com.au' getrepfmt='d'</pre> <p>Note: the getrepfmt command must come after the getrep command.</p>
getcfg	<p>Get the current setup sent to you via email. For example:</p> <pre>002716 getcfg='reports@halytech.com.au'</pre> <p>An email will then be sent to the specified address with the setup file as an attachment.</p>

For example: Retrieving all records from the last daily report onwards in the automatic report's configured format:

```
002716 getrep='reports@halytech.com.au'
```

For example: Retrieving all data from the last 3 days in diagnostic format:

```
002716 getrep3='joeblogs@halytech.com.au' getrepfmt='d'
```

For example: Retrieving all data from July and August 2016 in multi-column format:

```
002716 getrepd='01/08/16-30/09/16 joeblogs@halytech.com.au' getrepfmt='m'
```

Appendix D2. General settings

Command	Description
location	Location name
long_location	Long location name
log_per	General logging period Valid logging periods include '1s', '2s', '3s', '5s', '10s', '15s', '20s', '30s', '1m', '2m', '3m', '5m', '10m', '15m', '20m', '30m', '1h', '2h', '3h', '4h', '6h', '12h' and '1d'

For example: changing the general logging period 5 minutes:

```
002716 log_per='5m'
```

Appendix D3. User settings

Command	Description
nuser	Admin username
npass	Admin password
cuser	User username
cpass	User password

Appendix D4. LAN settings

Command	Description
ip_my	hydroSpider IP address (default: 192.168.0.177)
ip_subnet	Subnet mask (default: 255.255.255.0)
esy_cn	Easy connect enable 0 = disabled, 1 = enabled

Appendix D5. WAN / Internet settings

Command	Description
wan_method	Select how hydroSpider will connect to WAN / Internet. 'mobile' = Mobile Internet (modem), 'lan' = Local Network (LAN)
gapn	APN
gath	GPRS (SIM) authentication enable 0 = disabled, 1 = enabled
gusr	GPRS Username (if GPRS authentication is enabled)
gpas	GPRS Password (if GPRS authentication is enabled)
ip_gateway	Gateway IP
ip_dns1	Primary DNS IP
ip_dns2	Secondary DNS IP

For example: changing the APN and disabling GPRS authentication:

```
002716 gapn='telstra.internet' gath='0'
```

For example: changing the APN and enabling GPRS authentication:

```
002716 gapn='telstra.internet' gath='1' gusr='myUser' gpas='myPass'
```

Appendix D6. Date / Time settings:

Command	Description
ntpen	NTP enable 0 = disabled, 1 = enabled
ntphost	NTP server

Appendix D7. Automatic software updates

Command	Description
remupgmthd	Method used for software updates 0 = Halytech Upgrade Server, 1 = Self-Managed FTP Server
remupg	Automatic software upgrades enable 0 = disabled, 1 = enabled
ftpdsvr	FTP server
ftpdusr	FTP username
ftpdpas	FTP password
ftpddir	Software file directory (use '/', not '\', in directory names)
ftprdir	Response directory (use '/', not '\', in directory names)

Appendix D8. Automatic setup updates

Command	Description
remcfg	Automatic setup update enable 0 = disabled, 1 = enabled
ftpdsvrc	FTP server
ftpdusrc	FTP username
ftpdpasc	FTP password
ftpddirc	Setup file directory (use '/', not '\', in directory names)
ftprdirc	Response directory (use '/', not '\', in directory names)

Appendix D9. Email settings

Command	Description
smtp	SMTP server
smau	SMTP authentication enable 0 = disabled, 1 = enabled
smusr	SMTP username (if SMTP authentication is enabled)
smpas	SMTP password (if SMTP authentication is enabled)
meml	hydroSpider's email address (the From address in emails sent by the hydroSpider)

Appendix D10. Automatic reports

Command	Description
repN_period	Automatic report period N = 0 for automatic report 1, or N = 1 for automatic report 2 Valid report periods include '1m', '5m', '10m', '15m', '20m', '30m', '1h', '2h', '3h', '4h', '6h', '12h' and '1d' E.g. rep0_period='6h' would set the automatic report 1 period to 6 hours
repN_offset	Automatic report offset in hours, minutes and/or seconds N = 0 for automatic report 1, or N = 1 for automatic report 2 The offset is given as a number followed by 'h', 'm' or 's' to specify hours, minutes or seconds. Combinations are also possible. E.g. rep1_offset='1h5m20s' would set the automatic report 2 offset to 1 hour, 5 minutes and 20 seconds
repN_format	Report format N = 0 for automatic report 1, 1 for automatic report 2, or 2 for alarm reports Valid formats are: r = Raw f = Filtered d = Diagnostic m = Multi-column a = Aligned multi-column u = User-ID s = User-ID with controls
repN_direction	Report time order N = 0 for automatic report 1, 1 for automatic report 2, or 2 for alarm reports 'dec' = decreasing, 'inc' = increasing
repN_recovery	Automatic report recovery enable N = 0 for automatic report 1, or N = 1 for automatic report 2 '0' = disabled, '1' = enabled
repN_subject	Report email subject (only applicable to reports sent by email) N = 0 for automatic report 1, 1 for automatic report 2, or 2 for alarm reports E.g. rep2_subject='Alarm report'
repN_email	Email reporting enable N = 0 for automatic report 1, 1 for automatic report 2, or 2 for alarm reports 'none' = disabled, '0' = enabled (this is not a typo: '0' means that reports will be emailed) E.g. rep1_email='0' will send automatic report 2 via email
emr_ad0	Reports email address 1
emr_ad1	Reports email address 2
emr_ad2	Reports email address 3
repN_ftp	FTP reporting enable N = 0 for automatic report 1, 1 for automatic report 2, or 2 for alarm reports 'none' = disabled '0' = send reports to FTP Server 1 '1' = send reports to FTP Server 2 '0,1' = send reports to both FTP servers

ftpN_server	FTP server N = 0 for FTP Server 1, or N = 1 for FTP Server 2 E.g. ftp0_server='ftp.abc.com' sets FTP Server 1 to "ftp.abc.com"
ftpN_user	FTP username N = 0 for FTP Server 1, or N = 1 for FTP Server 2
ftpN_pass	FTP password N = 0 for FTP Server 1, or N = 1 for FTP Server 2
ftpN_up	FTP directory (use '/', not '\', in directory names) N = 0 for FTP Server 1, or N = 1 for FTP Server 2

For example: enabling automatic software upgrades and configuring the software upgrade settings:

```
002716 remupg='1' ftpdsvr='ftp.halytech.com.au' ftpdusr='joeuser' ftpdpass='joepass'
ftpddir='/hydroSpider/upgrades/' ftpudir='/hydroSpider/reply/'
```

For example: changing the period of automatic report 1 to hourly, enable emailing of reports, and setting 2 report email addresses:

```
002716 rep0_period='1h' rep0_email='0' emr_ad0='joeblogs@halytech.com.au'
emr_ad1='janeblogs@halytech.com.au'
```

For example: changing the format of automatic report 2 to filtered:

```
002716 rep1_format='f'
```

Appendix D11. Alarm settings

Command	Description
eem_al0	Email alert enable 0 = disabled, 1 = enabled
ad0_al0	1 st Email alert address
ad1_al0	2 nd Email alert address
ad2_al0	3 rd Email alert address
esm_al0	SMS alert enable 0 = disabled, 1 = enabled
ph0_al0	1 st SMS alert phone number
ph1_al0	2 nd SMS alert phone number
ph2_al0	3 rd SMS alert phone number
etm_al0	Tweet alert enable 0 = disabled, 1 = enabled

Note: these settings apply for all other alarms as well. Simply replace the trailing '0' in the above commands. For example, for Alarm 3, the commands would be eem_al2, ad0_al2, etc.

Note: alarms are numbered starting from 0. So alarm 1 has identifier 0, alarm 2 has identifier 1, ..., and alarm 8 has identifier 7.

For example: disabling SMS sending on alarm 7, enabling email alarms on alarm 6, and changing the 1st email alert address on alarm 6:

```
002716 esm_al6='0' eem_al5='1' ad0_al5=alerts@halytech.com.au'
```

Appendix D12. Advanced settings

Command	Description
controlN_wuptime	Control Warmup time N = 0 for Switched Power Out, 1 for Open Collector Valid warmup times include '100ms', '1s', '2s', '3s', '5s', '10s', '15s', '20s', '30s', '1m', '2m', '3m', '5m' and '10m' E.g. control1_wuptime='10s' sets the open collector warmup time to 10 sec
prst	Periodic reset offset (applies to inputs with periodic reset enabled) in hours and/or minutes E.g. prst='1h30m' sets the periodic reset offset to 1 hour and 30 minutes

Appendix D13. Combined example

In this example, we will be doing all of the following:

- Changing the APN and disabling GPRS authentication
- Changing the mail server and enabling SMTP authentication
- Setting the email username and password
- Setting the hydroSpider's 'from' email address
- Setting up an automatic report (1) with:
 - period = daily
 - start time = 6am
 - format = filtered
 - time order = decreasing
 - report recovery enabled
 - Report to be sent to a specified email address

We need to send 2 SMS messages to achieve this since a single one would exceed the 160 character limit. The SMS messages would be sent as follows:

- SMS 1 (142 characters):
002716 gapn='telstra.internet' gath='0' smtp='mail.bigpond.com' smau='1'
smusr='username' smpas='password' meml='hydroSpider@halytech.com.au'
- SMS 2 (149 characters):
002716 rep0_period='1d' rep0_offset='6h' rep0_format='f' rep0_direction='dec'
rep0_recovery='1' rep0_email='0' emr_ad0='joeblogs@halytech.com.au'

Appendix D14. Remote channel calibration

The hydroSpider allows channel offsets to be adjusted remotely by comparing logged data with known values supplied by the user. The user supplies the hydroSpider with the value of a reading as well as the time and date when that reading was taken. The hydroSpider then matches up its logged data with this reading and adjusts the channel's offset to correct any discrepancy.

The following channel types can be remotely calibrated: Counter and Event.

Note: the pulses / unit of measure of a channel should be set correctly via the web interface before using Remote SMS Calibration

Command	Description
cal0	Calibrate channel 1
cal1	Calibrate channel 2
cal2	Calibrate channel 3
cal3	Calibrate channel 4

This pattern continues up to "cal7", which is used to calibrate channel 8 (or up to "cal15" if your hydrospider has the SDI-12 / RS-485 option)

The message should be in the format format:

```
002716 cal0='<value> <dd/mm/yyyy> <hh:mm:ss>'
```

For example, if the value of channel 1 is 5300, the date is 02/12/2016 and the time is 13:51:00, then message would be:

```
002716 cal0='5300 02/12/2016 13:51:00'
```

For example: consider the following scenario:

A technician has finished installing a hydroSpider which is connected to an electricity meter. The pulse rate has been correctly calibrated within the hydroSpider to 10 pulses per kWh, however the actual reading on the meter does not match what is showing on the hydroSpider.

Attempting to read the meter and update the hydroSpider via the web-browser at that exact instance may not always be possible (for example: when the meter is far from the hydroSpider). To solve this, the technician notes down the actual reading from the electricity meter and the date and time of this reading. In this example, say the reading was 5300kWh and was taken on 02/12/2016 at 13:51:00. The technician sends an SMS to the hydroSpider with that data, asking it to calibrate the channel:

```
002716 cal0='5300 02/12/2016 13:51:00'
```

When the hydroSpider receives this SMS, it will search through its own log file, calculate the difference between its own logged data for the channel at the date/time given and the value provided via SMS, and then apply a correction to future logged data.

Appendix D15. Response to SMS Commands

In response to a valid SMS command, the hydroSpider will send a reply SMS message. This message contains the following text:

<location>: processed *<x>* variables.

Where *<location>* is the location name, and *<x>* is the number of variables you sent in your message.

For example, in response to the message:

```
002716 getrep='reports@halytech.com.au' getrepfmt='d'
```

The hydroSpider with serial number 002716 and location name 'myHydroSpider' would reply with the response SMS message:

```
myHydroSpider: processed 2 variables.
```

Note: As mentioned earlier, if the serial number is incorrect, the hydroSpider will not respond to the SMS message.

Note: Because the hydroSpider keeps its modem off most of the time to save power, the SMS command may take some time to be received. See 5.7.5 - SMS Recovery for more information.

Appendix E. LiveSMS (Software Option)

LiveSMS functionality is available as a software option for the hydroSpider2.

It allows the hydroSpider to receive, reply and act on SMS messages in real time, and to remotely access the unit via a web browser. This allows the user to instantly change settings, request reports, get system information at any time, and acknowledge alarms.

LiveSMS is configured in the *Change Advanced Settings* page, which is reached by clicking the "Advanced" link in the *Change Setup* page.

LiveSMS will cause the hydroSpider to consume a lot more power as the modem may be left on for long periods of time.

The following **Type** options are available:

- Always: the modem is on at all times
- Schedule + Alarms: the modem is on at selected times, and when waiting for SMS alarm acknowledgement.
- Alarms Only: the modem is only left on when waiting for SMS alarm acknowledgement.

Note: If LiveSMS is set to Always, SMS Recovery (see 5.7.5 - SMS Recovery) will no longer be available as it is unnecessary.

SMS Messages which may be sent/received if LiveSMS is enabled:

Command	Comment	Example
HELP	Request list of supported commands	HELP
GET ST	Get current state of all inputs (System Channels Included)	GET ST
GET CN	Get current state of all controls	GET CN
GET AL	Get current state of all alarms	GET AL
ACK ALx	Acknowledge Alarm x (x is 1 - 8)	ACK AL6
ACK ALL	Acknowledge All Alarms	ACK ALL
ON CNx	Activate Control x (x is 1 = Switched Power, 2 = Open Collector) (no PIN)	ON CN2
yyyy ON CNx	Activate Control x (x is 1 = Switched Power, 2 = Open Collector) (PIN = yyyy)	1234 ON CN2
OFF CNx	Deactivate Control x (x is 1 = Switched Power, 2 = Open Collector) (no PIN)	OFF CN2
yyyy OFF CNx	Deactivate Control x (x is 1 = Switched Power, 2 = Open Collector) (PIN = yyyy)	1234 OFF CN2
PULSE CNx	Pulse Control x for 1 second (x is 1 = Switched Power, 2 = Open Collector) (no PIN)	PULSE CN2
yyyy PULSE CNx	Pulse Control x for 1 second (x is 1 = Switched Power, 2 = Open Collector) (PIN = yyyy)	1234 PULSE CN2
GET REP	Request Current Day's Report (sends out via FTP/Email using normal report settings)	GET REP

yyyy GPRS n,email	Request a remote connection (n = minutes to wait for you to connect, email = address where email with link will be sent; see Appendix F) (PIN = yyyy)	1234 GPRS 5,me@example.com
------------------------------	---	-------------------------------

After a hydroSpider receives an SMS command it will interpret it and act on it.

Invalid commands will be ignored.

Valid commands will be acknowledged with a return SMS:

Location: OK SMS command

Where:

"Location" is the programmed hydrospider2 location

"SMS command" is the SMS command

eg: **Mudgee STP: OK ACK AL1**

NOTES:

- Commands may be in lower or upper case or a combination of both
- There must be only one space between the words of a command
- SMS commands will not be received by the hydrospider2 while the modem is off, they will be received next time it turns on.
- If LiveSMS is disabled, the hydroSpider will never receive SMS commands, even if the modem is ON due to other reasons.

The following options are available:

SMS PIN:

Remote access, control activation and deactivation commands may be protected with a 4 digit PIN. If the PIN is set to "0000" it is effectively disabled. Any other 4 - digit number will enable the PIN. You can change the PIN at any time by accessing the Location & SMS PIN page and entering the PIN.

LiveSMS Alarms:

With Live SMS functionality enabled, you may choose to DISABLE auto acknowledgements. In this case, the alarm can only be acknowledged via either SMS or Webpages (requires LAN connection to device). While the alarm is unacknowledged, the hydrospider2 will keep its modem on to receive any incoming SMS messages, draining battery power. Therefore, Disabling Auto Acknowledgements may have significant impacts on battery life.

SMS acknowledge time:

This parameter is available as "Escalation time" in the SMS Alerts section of the Change Alarm pages, when Live SMS is enabled.

The Escalation time is the period of time (in minutes) during which an alarm must be acknowledged to stop the hydrospider2 from sending SMS to the next number on the list.

An Escalation time of 0 will cause SMS messages to be sent to all phone numbers immediately.

Appendix E1. Controlling another unit via SMS

The hydroSpider2 can control remote microSpider2 and hydroSpider2 units via SMS.

This is accomplished using alarms which send specialised LiveSMS commands:

Command	Comment	Example
ON REMx	Activate control x on the remote unit	ON REM2
OFF REMx	Deactivate control x on the remote unit	OFF REM2
PLS REMx	Pulse Control x on the remote unit for 1 second	PLS REM2

For each of these commands, such as ON REMx:

x is 1 = Switched Power, 2 = Open Collector, 3 = Low Voltage Out⁴ and 4 = SDI-12 Command

To control a remote unit, LiveSMS must be enabled on the local hydrospider2 and an alarm must first setup on the local unit, with the appropriate command (e.g. ON REM1) entered into the alarm Message field.

The phone number of the remote unit entered must be entered into one or more of the phone number fields in the SMS Alerts section.

The alarm Escalation time specifies how long the local hydrospider2 will wait for acknowledgement from the remote unit, before sending the command again. Up to three attempts will be made, one for each entry of the remote unit's number in the alarm's phone number fields.

There is no special setup required on the remote unit, but it must have the LiveSMS software option and its modem must be on, in order to receive the remote SMS command, which means that it must be set to 'Always' or 'Schedule + Alarms'.

Additionally, the two units must have their times synchronised, to within 10 minutes of each other. This is to prevent the remote unit responding to old commands which were delayed by the phone network.

For example, we will consider a system comprising two hydroSpider2 units.

The local hydroSpider2 unit is measuring a water level, and a pump is controlled by the remote hydroSpider2.

When the level falls below 1m, we want the local unit to send a command to the remote unit, instructing it to turn on the pump.

We will assume that the pump is controlled by switched power out (= control 1), and that the phone number of the remote unit is 041235678.

⁴ Low Voltage Out is not available on the hydroSpider2, but is applicable when controlling a microSpider2

An alarm would be setup on the local unit to as illustrated below:

Change Alarm 'Pump ON'

Alarm name	<input type="text" value="Pump ON"/>
Trigger source	<input style="background-color: #e0e0e0; border: 1px solid #ccc;" type="text" value="Analogue 3: Water Level"/>
Trigger level	<input style="background-color: #e0e0e0; border: 1px solid #ccc;" type="text" value="Below"/> <input type="text" value="1.000"/>
Qualifying time	<input type="text" value="0"/> second(s)
Control action	<input style="background-color: #e0e0e0; border: 1px solid #ccc;" type="text" value="Disabled"/>
Log action	<input type="checkbox"/> Log additional channel
Send alarm report	<input style="background-color: #e0e0e0; border: 1px solid #ccc;" type="text" value="Disabled"/>
Fast logging	<input type="checkbox"/>
Message	<input type="text" value="ON REM1"/>
Auto acknowledge	<input checked="" type="checkbox"/>
Auto acknowledge time	<input type="text" value="60"/> minute(s)

SMS Alerts

1st phone number	<input type="text" value="0412345678"/>
2nd phone number	<input type="text" value="0412345678"/>
3rd phone number	<input type="text"/>
Escalation time	<input type="text" value="3"/> minute(s)

Email Alerts

Twitter Alerts

DNP3 Alerts

When the water level falls below 1m, the alarm will trigger and send the control command to the remote hydroSpider2.

If the remote hydroSpider2 receives the command and it is within 10 minutes of its own time, it will turn control 1 (switched power out) on, activating the pump. It will then send a response SMS back to the local unit, acknowledging the command to stop further sending attempts by the local hydroSpider2. If the command is not within 10 minutes of its own time, the remote unit will not activate the control, but it will still send the acknowledgement response.

The local hydroSpider2's escalation time is set to 3 minutes. If it does not receive an acknowledgement from the remote hydroSpider2 within that time, it will re-send the control command, because the remote unit's phone number has been entered twice into the phone number

fields. However, if there is still no acknowledgement after the second attempt, it will not retry a third time, because the 3rd phone number field is empty.

Auto acknowledge time on the local hydroSpider2 alarm is set to 60 minutes. Hence, 60 minutes after the alarm trigger, the alarm will be auto acknowledged. This will allow the alarm to send a new series of SMS commands if the water level goes inactive (above 1m) and then again goes active (below 1m).

The Auto Acknowledge Time of 60 minutes ensures that remote SMS commands are not sent more often than every 60 minutes, which could happen with water levels that change quickly.

Using the same logic, another alarm could be setup on the local hydroSpider2 to turn the pump off. Its trigger would be Water Level Above (for example) 2m and the Message should be 'OFF REM1', with all other settings identical to the alarm described previously.

Appendix F. Connecting to a hydrospider2 Remotely (LiveSMS only)

If you have the LiveSMS software option, you can connect remotely to the hydrospider2:

1. Send this SMS command to the hydrospider2:

yyyy GPRS n,yourEmailAddress

where: yyyy is the optional LiveSMS PIN – leave this blank if no PIN has been set
n = number of minutes the system will wait on line for you to connect
(10 is a good choice)
yourEmailAddress = email address where email with link will be sent

e.g. if you want the unit to go online and wait 10 minutes for you to connect and your email address is me@example.com, and you have not setup a LiveSMS PIN, the actual SMS would be

GPRS 10,me@example.com

NOTE that there is a space between GPRS and 10, and no spaces either before or after the comma (,).

2. The hydrospider2 will respond with an SMS acknowledging your message.
3. The hydrospider2 will then send an email to the email address nominated above.
4. Open the email and click the link.
5. Your browser will open and the log-on page will be displayed⁵. Enter your username and password and log in as usual.
6. You can now access all the web pages, as described earlier in this manual.

You can use any device with a supported Internet browser that is connected to the internet such a PC, laptop, iPad and even your phone.

Supported Browsers

The hydrospider2 supports remote access via the following Internet browsers (other browsers may also work):

Internet Explorer 11
Microsoft Edge
Chrome
Safari

NOTE: your browser must have Javascript enabled.

⁵ Note: to speed up the remote access, many of the web page elements are loaded from a Halytech web server. If your web browser is unable to access the server, these elements will be loaded into your browser's web cache, before the login page appears. This caching process may take a few minutes to complete.

NOTE: Remote access has four pre-requisites. If required, make the appropriate changes as suggested in each point below. Any change needs to be done only once.

1. You are using a SIM card enabled for dynamic public IP address

If you are in Australia, you can obtain a SIM card on a post-paid plan from Telstra and request that a **dynamic public IP address** be added to you SIM. This is provided for free. Simply advise Telstra to set the following parameters on your SIM:

GPTEXB3
GPCORPB3

2. The Internet method must be set to "Mobile Internet (Modem)" and if you are using a Telstra SIM the APN must be set to "telstra.extranet" (see 5.7 - Network Parameters)
3. The E-mail settings need to be set up correctly (see 5.8 - Email)

IMPORTANT: It is strongly advised that you confirm that all settings affecting e-mails are correct. This done by sending a test e-mail as described in 5.8 - Email.

4. LiveSMS must be setup to turn the modem on, either always or at scheduled times. It is only possible to connect remotely while the modem is turned on (see Appendix E).

All of the hydrospider's usual functionality remains available while you are connected remotely.

Reports will continue to be sent as usual – if you're connected remotely while a report is being sent via the modem, your remote access will become slower (because the modem is sending a report at the same time that it's sending web pages to you), but will remain usable.

The remote access session will close after 5 minutes of inactivity, or 30 minutes overall.

If your remote access session stops responding (i.e. a page fails to load, even after you try to reload it), the session has probably closed. To reconnect, send the GPRS SMS command again.

If the modem is scheduled to turn off while you're remotely connected, the modem will remain on as long as the remote access session remains active. When the session closes, the modem will turn off and you will then need to wait until the modem is scheduled to turn on again before you can reconnect.

Appendix G. DNP3 (Software Option)

Distributed Network Protocol (DNP3), available as a software option, allows a hydrospider2 to participate in a SCADA environment as an intelligent remote terminal unit (RTU) or outstation, where it is monitored by a central master station or server.

The hydrospider2 complies with the level 2 subset of the DNP3 protocol (DNP3-L2).

To support low-power operation, the hydrospider2 can be configured to connect to the DNP3 server and transmit logged data (via “unsolicited responses”) periodically and/or whenever specific alarms are triggered. No special SIM or IP addressing is required.

Appendix G1. DNP3 communications settings

The hydrospider2 can communicate with the DNP3 master server through either a LAN (network) or modem (mobile internet) connection, depending on the Internet method selected on the [Change Network Settings](#) page.

In LAN mode, the hydrospider2 will listen for an incoming connection from the DNP3 server. The SCADA system must be configured to connect to the hydrospider2's IP address on the Ethernet LAN.

More commonly, the hydrospider2 will use the modem for Internet communications and it would usually be configured to actively connect to the DNP3 server periodically or in response to alarms.

Note that it is also possible, through the advanced settings page, to enable “Listen” mode with a modem if you have the LiveSMS option and you have configured the modem to be always on, or on at scheduled times. However that you would need to use a SIM with a public IP address, or part of a private network (VPN) that your SCADA server can connect to. Note also that, even when your modem has a public IP address, it will usually be assigned a new address every time it turns on, and you need to know the unit's IP address so that you can enter it into your SCADA system. For these reasons, unless you have a SIM that provides a static IP address, using DNP3 in “listen” mode isn't recommended for modem connections.

The DNP3 Communications settings are found on the Change DNP3 Settings page, accessed via a “DNP3” link from the Change Setup page:

DNP3 Communications Setup	
Server IP address 1	<input type="text"/>
Server IP address 2	<input type="text"/>
Server IP address 3	<input type="text"/>
Server port	<input type="text" value="20000"/>
Local DNP3 address	<input type="text" value="4"/>
Server DNP3 address	<input type="text" value="3"/>
Status	disabled
<input type="button" value="Save and Restart DNP3"/>	
<small>Note: to enable DNP3, enter at least one server address or select listen in advanced settings</small>	

The following options are available:

- **Server IP addresses:** The IP addresses of up to three DNP3 master servers. These are the addresses of the DNP3 servers to connect or listen to. When connecting to a master server, the hydroSpider2 will try each IP address in turn, until the connection is successful.

In listen mode, these fields can be left blank to allow any master server to connect. Otherwise, if you specify any server IP addresses in listen mode, incoming connections will only be accepted from the specified server.

Note that if you're using a modem connection (not an internal LAN), the servers must be accessible from the Internet and you would specify their external public IP addresses here (check with your IT support), not their internal network addresses.
- **Server port:** The TCP port number to connect to (not applicable in listen mode). The default is the standard DNP3 port, 20000.
- **Local DNP3 address:** The DNP3 address of this outstation. The default is 4. You may need to change this if your DNP3 master has a number of outstations, as each outstation on the network must have a unique DNP3 address.
- **Server DNP3 address:** The DNP3 address of the master. The default is 3, which is the usual default address for DNP3 master stations
- **Listen port:** The TCP port number to listen on (only applicable in listen mode). The default is the standard DNP3 port, 20000.
- **Status:** Shows the connection status, such as closed, listening, connecting or connected, along with the IP address the unit is connecting to or listening on

When you have entered or updated the DNP3 communications settings, click on the "Save and Restart DNP3" button to immediately attempt a new connection (or restart the current connection) with the new settings.

The "Status" line shows the progress of the connection attempt, including any connection failures. This allows you to check that the DNP3 connection has been successfully established before you leave Change Setup.

This status display is also available on the DNP3 page under View Setup, so that you can check whether the unit is connected to a DNP3 server or listening for an incoming connection, at any time.

Appendix G2. DNP3 Event Reporting

These settings specify whether data will be sent as unsolicited responses to the DNP3 master, whether all logged data will be sent or only changes and, if you're using the modem to actively connect to a DNP3 server, how often to send them.

By default, every logged input value is considered to be a DNP3 event and will be sent to the DNP3 master⁶. When a LAN connection is used, these events are sent continually, whenever a change in value is logged. But when the modem is used to connect to the server (i.e. not in listen mode), these events are sent periodically, to limit how often the modem turns on.

⁶ The "Reset starting point" button on the Change Report Settings page can be used to mark all data logged up to this point in time as "sent", so that it will not be sent to the DNP3 server.

To limit the amount of data reported to the server, DNP3 events can be generated only when the logged value of an input channel changes. By sending changes in the logged data as a sequence of events, the DNP3 master can reconstruct the complete history of each input channel (or "point"). This process is the DNP3 equivalent of sending periodic automatic reports via email or FTP, and can be used instead of or in conjunction with automatic reports.

DNP3 Event Reporting	
Enable Unsolicited	<input checked="" type="checkbox"/>
Report all logged data	<input checked="" type="checkbox"/>
Period	1 hour ▼
Fast Period	5 minutes ▼
Offset	0 hours 0 minutes 0 seconds

The following options are available:

- **Enable Unsolicited:** Whether to send unsolicited responses to the server.
- **Report all logged data:** If cleared, only changes in input values will be reported as DNP3 events, and the hydrospider2 will only attempt to connect to the DNP3 server when it has some changed data to report.
- **Period:** How often to report events by sending unsolicited responses. Choose from options between 1 minute and 1 day, or "Off" to disable periodic reporting
- **Fast Period:** How often to report events while an alarm with "Repeat (fast period)" enabled is active (see DNP3 alarms)
- **Offset:** Choose a delay to add to the event sending time. This is mainly useful in three situations:
 - When you want to send events daily at a time other than midnight. E.g.: to send events at 6:30am, set the offset to 6 hours and 30 minutes.
 - If you also send automatic reports, you may wish to send DNP3 events at a different time to the report, to ensure that the report is not delayed while the unsolicited responses are sent.
 - When you want to include data that is logged slightly after events are usually sent out. E.g.: SDI-12 channels take between 0.1s and 1s to respond. This means they won't be included as events if they are sent exactly on the hour. Adding an offset of 10 seconds will ensure these late-running sensors are included.

Note: if you're using the modem to actively connect to the server ("Listen" is disabled), you must not disable unsolicited responses. The modem only tries to connect when there is data to send, and if unsolicited responses are disabled, there will never be any DNP3 data to send, so the connection with the server will never be established.

Appendix G3. DNP3 alarms

When using a modem to connect to the DNP3 server, the hydrospider2 can periodically update the server, as described above.

However, you may need you SCADA system to become immediately aware of certain input conditions, such as a switch closing or a sensor input going above or below some threshold, instead of having to wait for the next regular update.

You can do this by setting up an alarm as usual (see [Setting up Alarms](#)), and selecting “DNP3 Alerts” as one of the alarm alerting options:

Change Alarm 'Switch closed'

Alarm name

Trigger source

Trigger when

Qualifying time second(s)

+ Show More Settings

SMS Alerts

Email Alerts

Twitter Alerts

DNP3 Alerts

Send Unsolicited Response

Once only
Repeat (fast period)

When the alarm becomes active, the hydrospider2 will connect to the DNP3 master server and send any unsent events (as unsolicited responses) to the server.

Because a DNP3 event is generated whenever an input changes, one of the events sent to the server will be the most recent change which activated the alarm.

Note that a corresponding alarm must also be setup in the SCADA system.

The SCADA system will only see the new input level. There is nothing in a DNP3 event that marks it as being any more special than any other event – they are all considered to be “interesting” and it is up to the SCADA system to assign significance to them.

The hydrospider2 sends data about changed inputs to the DNP3 master. When a DNP3 alarm occurs on the hydrospider2, the data will be sent immediately. But it's always up to the DNP3 master to interpret the data sent by an outstation.

To continue to send events while the alarm is active, select the “**Repeat (fast period)**” dropdown menu option. The hydrospider2 will continue to connect, at the rate specified by the “Fast Period”

specified on the Change DNP3 Settings page (see above), until the alarm goes inactive. This allows you to monitor an alarm situation, with faster updates than the normal event reporting period.

Note also that the “DNP3 Alerts” option can be selected in addition to or instead of any other alarm option. For example, you could set up an alarm that, when triggered, activates a control, sends an SMS, emails a report, and sends an immediate update via DNP3 to the SCADA system.

Appendix G4. DNP3 input point mapping

A hydrospider2 can have up to eight input channels (sixteen if you have the SDI-12 / RS-485 interface option), numbered from 1 to 8 (or 16), and each input can be one of a number of types such as a Switch, Counter, 4-20mA, SDI-12, or system channels such as temperature or battery voltage (see [Configuring Inputs](#)).

DNP3 on the other hand considers outstations to have a set of input *points*, which can be one of three types: binary inputs (on/off), analog inputs (signed decimal values such as -12.34) and counter inputs (non-negative integers, such as 1234, which increment over time).

An outstation will typically have some number (an array) of each type of input point. Each array of points is indexed starting from 0.

To use DNP3 to collect data from a hydrospider2, it's necessary to understand how the hydrospider2's input channels correspond to DNP3 input points.

The following table lists the hydrospider2 input channel types and the corresponding DNP3 point types:

Channel type	DNP3 Input Point type	Additional DNP3 Input Point type
Switch	Binary	
Counter	Counter	Analog
Event	Counter	Analog
Analogue (Voltage)	Analog	
Analogue (4-20mA)	Analog	
Quadrature	Analog	
Difference	Analog	
SDI-12	Analog	
Modbus-485	Analog	
System (Voltage)	Analog	
System (Temperature)	Analog	
System (Moisture)	Analog	
Super Channel	Analog	

As you can see, most channel types correspond to DNP3 analog inputs.

The analog value reported to DNP3 is the calibrated value as shown on the Current Inputs page and included in reports. For example, if you've calibrated a hydrospider2 input to report in metres, DNP3 will see the calibrated value in metres. There is no need to perform any additional scaling or calibration in the SCADA system.

Note that the underlying calibrated value is reported via DNP3, even if you've selected "Log difference" for a channel.

Counter and event channels are mapped into to DNP3 counter inputs which, as required by the DNP3 spec, are non-negative integer (whole) values which continue to increment until they are reset, after which they continue to count up.

However, the hydrospider2 allows counter and event channels to be calibrated to represent real-world engineering quantities (e.g. litres) instead of the raw count from a meter, and these calibrated values are those visible on the Current Inputs page and included in reports.

To make it possible to access the calibrated counter or event values from your SCADA system, counter and event channels are also mapped into DNP3 analog input points, which represent the calibrated value of each channel.

When setting up a hydrospider2 counter or event channel in your SCADA system, you can choose to access the counter and/or analog input point corresponding to that channel.

The counter input point will appear as a 32-bit integer (0 – 4294967295) while the corresponding analog input point will report a real (floating point, decimal) value in engineering units.

So why use the counter input point type for a counter or event channel? Because only counter input points support the DNP3 *freeze* and *clear* operations.

When a counter is frozen, its value is copied into a corresponding "frozen counter" point. The frozen value is retained, even as the counter input continues to increment. These frozen counter points can then be queried by the SCADA system at any time. An advantage of this is that the SCADA system can tell the outstation to freeze all its counters, providing a snapshot at a point in time, and then the frozen counts can be read one at a time.

The SCADA system can also clear (reset) counter input points to zero. DNP3 only allows counter points to be cleared. So, if you want to be able to use the SCADA system to clear counter or event inputs, you will need to set it up to operate on the counter point associated with that channel, even if you are using the corresponding analog point for reporting.

Subtract 1 from the channel number to get the corresponding point index:

Channel 1 = point 0

Channel 2 = point 1

Channel 8 = point 7

For example, with the following input setup:

	Type	Source	Name	User ID	Units	Logging	
1	Switch	Digital 1	Float	0		Auto	 
2	Counter	Digital 2	Flow	1		General	  
3	Analogue (Voltage)	Analogue 1	Pressure	2		General	 
4	Disabled						

The "Float" input would be binary input point 0,

"Flow" would be available as counter input point 1 and **also** as analog input point 1,

"Pressure" would be analog input point 2.

Additionally, frozen counter point 1 would hold a static copy of the raw "Flow" value after a freeze operation is performed on counter point 1.

Appendix G5. DNP3 output point mapping

The hydrospider2 provides up to two controls which can be used to turn devices on or off (see [Controls](#)).

DNP3 supports two types of *output points*: binary outputs (on/off) and analog outputs (continuously variable). As with input points, each type of output point is indexed, starting from 0.

The hydrospider2's controls are binary outputs and are mapped to DNP3 output points, as follows:

hydrospider2 Control	DNP3 binary output point index
Switched Power Out	0
Open Collector	1

The controls support the "LATCH_ON", "LATCH_OFF" operation types to turn each control on or off. The "PULSE_ON" operation can also be used to output a single pulse with an "on" time between 100 ms and 600 sec. Note that multiple pulses (count > 1) are not supported.

The hydrospider2 supports all of the DNP3 binary output command (control relay output block, or "CROB") actions, including *select*, *operate* and *direct operate*.

DNP3 will not activate a control if it is being forced on by an alarm or the web interface, or if it is used for sensor warmup.

Note that if DNP3 has requested a control to turn on and an alarm forces that control off, the control will remain off while the alarm is active and then DNP3 will turn it on again.

The status of each output point can be read (polled) at any time.

Appendix G6. Setting the clock

DNP3 can be used to set the hydrospider2's date and time.

The hydrospider2 uses UTC (Coordinated Universal Time) internally and the SCADA system should be configured for the outstation to report UTC times.

Note that if your SCADA system is regularly updating the hydrospider2's clock, there is no need to also use NTP (but it doesn't hurt to use both).

Appendix G7. Resetting the hydroSpider2

DNP3 can be used to remotely reset (reboot) the hydrospider2.

A "warm reset" will restart DNP3, having the same effect as the "Save and Restart DNP3" button on the Change DNP3 Settings page. Note that a warm reset only affects the DNP3 functionality.

A "cold reset" will restart (reboot) the hydrospider2. This is the same as turning the hydrospider2 off and on again (in fact, the log will record a "power on" event, even though power is not actually lost). Any current activity such as sending a report will be aborted and all alarms will be reset to their inactive state.

The warm and cold resets will both cause the DNP3 connection to drop out. It can be re-established after a minute or two – if the unit had been in listen mode, it will resume listening for a DNP3 connection following the reset, or if it was in active connect mode it will attempt to reconnect to the DNP3 server.

These reset commands should never be needed in practice but have been implemented for full compliance with the DNP3 standard.

Appendix G8. Reading device attributes

The hydrospider2 reports a number of “device attributes” via DNP3.

These include the software version, serial number, long and short location names, the product name (“hydrospider2”) and hardware version: ‘40’ for a standard hydrospider2, or ‘41’ for a hydrospider2 with SDI-12 / RS-485 interface.

This allows you to correctly identify the hydrospider2 unit in your SCADA system.

Appendix G9. Transferring setup files and software upgrades

DNP3’s file transfer functionality can be used to

- Read the hydrospider2’s current configuration and save it as a setup file
- Write a setup file to the hydrospider2, to update its configuration
- Upgrade the hydrospider2’s software (firmware)

Authentication

Read or write access to files requires authentication, using the standard DNP3 file access authentication mechanism, before any file can be opened.

The current administrator account (see 5.3 - Username and password) is required for read and write access to the unit’s configuration file, and for write access to the unit’s firmware.

The administrator has a factory default username of “user” and a password of “changeme”.

Note that it is not possible to read the hydrospider2’s current firmware (it can only be written to) and that the configuration and firmware files on the unit cannot be deleted.

Reading the current configuration

The current hydrospider2 configuration can be uploaded to the master server as a setup file.

This setup file is exactly the same as that uploaded via “Save Setup to Disk” in the web interface (see 5.15 - Manual Setup Management).

The name of the setup (or configuration) file on the hydrospider2 is in the form:

msc<serial number>.cfg

For example, if your hydrospider’s serial number is 00282C, the DNP3 server should request a read of the file named msc00282C.cfg on the outstation.

(The same filename is used in automatic setup updates – see 5.13 - Automatic Setup Updates).

Note that the filename is case sensitive. Any letters in the serial number must be in UPPER CASE.

Updating the configuration

To update the hydrospider2's configuration, download an updated setup file to it and then send a DNP3 "activate configuration" request.

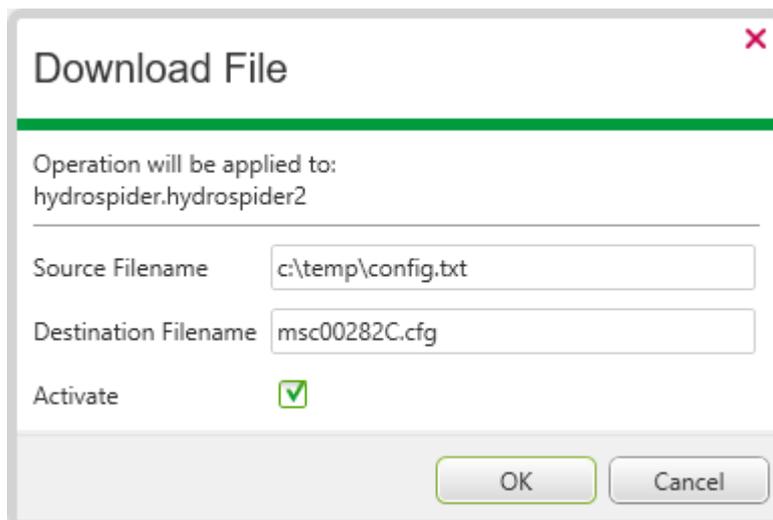
The name of the setup (or configuration) file on the hydrospider2 is in the form:

`msc<serial number>.cfg`

This is the same as the filename used to read the configuration, and the setup file should be in the format detailed in Appendix L - Setup file format.

Note again that the new configuration must be *activated* after the setup file has been transferred.

For example, the "Download File" facility in ClearSCADA provides an "Activate" checkbox that must be selected in order to activate the new configuration:



Software upgrades

To upgrade the hydrospider2's software, download a firmware file (provided by Halytech) to it and then send a DNP3 "activate configuration" request.

The name of the software (or firmware) file on the hydroSpider2 is in the form:

`msf<serial number>.hal`

For example, if your hydrospider's serial number is 00282C, the DNP3 server should write to the file named msf00282C.hal on the outstation.

(The same filename is used in automatic software upgrades – see 5.14 - Automatic Software Upgrades).

Note that the filename is case sensitive. Any letters in the serial number must be in UPPER CASE.

Downloading a firmware file over a modem (3G) connection will usually take around 10 minutes. However, if the DNP3 server requests data link confirmations, the file transfer will be significantly slower. Since the underlying TCP/IP protocol provides a reliable data connection, including acknowledgement of transmitted frames, ***we recommend that link layer confirmations be disabled*** when uploading firmware files.

Note again that the new software must be *activated*, after the file has been transferred, in the same way as for a new configuration (see screenshot, above).

The hydrospider2 will then reboot to install the software upgrade, a process that will take up to 90 seconds.

Appendix G10. Advanced DNP3 Settings

Some additional DNP3 settings can be configured in the *Change Advanced Settings* page, which is reached by clicking the "Advanced" link in the *Change Setup* page:

DNP3 Settings	
Listen Mode	<input checked="" type="checkbox"/>
Send Level 2 Responses Only	<input type="checkbox"/>
Event Buffer Size	<input type="text" value="65535"/>
Unsolicited Confirm Timeout	<input type="text" value="default"/>
Unsolicited Retry Delay	<input type="text" value="default"/>
Unsolicited Offline Delay	<input type="text" value="default"/>
Unsolicited Max Retries	<input type="text" value="default"/>
Restore DNP3 Defaults	

The following options are available:

- **Listen Mode:** Specifies the connection mode
 - **Enabled:** Listen for a connection from a DNP3 server.
Listen mode is usually used when the server connection is via the LAN.
If you've selected the modem as the Internet method, the unit will listen for an incoming connection whenever the modem is on (this can be scheduled if you have the LiveSMS software option).
 - **Disabled:** Actively connect to a DNP3 server.
This mode is only available when using a modem to connect to the DNP3 master. The modem will only turn on when required (saving power) and a SIM card with a

public IP address is not required. After the initial connection with the DNP3 master is established, the modem will turn off until needed.

Note that your SCADA system must be able to be configured to allow incoming connections to support this mode. For example, ClearSCADA provides for "Incoming Only" outstation communications availability, which is appropriate for this mode.

The connection mode is set automatically, depending on the configured Internet method (LAN or Modem), so you would not usually need to change this option.

However, if you are using the LAN, you may wish to disable listen mode, to disable the hydrospider's DNP3 function. Or, if you are using the modem, you can choose to enable listen mode if you have a SIM which provides a static public IP address.

The following advanced settings are required for strict Level 2 DNP3 standards conformance – in normal operation **there should be no need to change any of these settings**.

- **Send Level 2 Responses Only**

If this option is enabled, the unit will limit its responses to only those which a level 2 master is required to parse. Specifically, it will not include timestamps when reporting analog and counter events, and will only report analog inputs as integers. It will also no longer report the calibrated value of a counter or event input as a separate analog input point.

Note: Selecting this option will reduce the unit's DNP3 reporting capability.

- **Event Buffer Size**

This parameter specifies the number of unconfirmed events belonging to each group that can be queued before the "event buffer overflow" flag is set. It does **not** indicate that events have actually been lost, only that more than the specified number of events belonging to a single group (such as analog inputs) has been queued to be sent to the server. However, if the event buffer overflow flag is set, it is possible that subsequent events **may** be lost, so the server should retrieve some events.

Note: This parameter has no impact on the unit's ability to store and report events. There should never be any reason to change this setting.

- **Unsolicited Response settings**

The following four parameters define how often, and how many times, the unit will try to send each unsolicited response before receiving a confirmation from the server:

- **Unsolicited Confirm Timeout**

Time, in seconds, the unit will wait for the master to confirm that it has received an unsolicited response.

- **Unsolicited Retry Delay**

Additional time, in seconds, after an unsolicited response confirmation has timed out, to delay before resending the unsolicited response.

That is, after the unit sends an unsolicited response, it will wait for the timeout period to receive a confirmation message and then, if no confirm is received, it will wait an additional "retry delay" before sending the unsolicited response again. The total period between attempts is the timeout plus the retry delay.

- **Unsolicited Max Retries**

If initial unsolicited response is not confirmed, the unit will continue to retry the transmission, at the rate defined by the confirm timeout and retry delay, until the number of retries specified by this parameter have been made.

The unit then concludes that the server must be offline, and switches to "offline" mode.

- **Unsolicited Offline Delay**

Additional time, in seconds, after an unsolicited response confirmation has timed out, to delay before resending an unsolicited response in "offline" mode.

That is, after "max retries" attempts to resend an unsolicited response, the unit will continue to re-send unsolicited responses as before, but now the period between retries equals the confirm timeout plus this offline retry delay.

To disable retries in offline mode, enter an offline delay > 86400 seconds (= 1 day). This will be converted to 2678400, which is interpreted as an infinite delay. The total number of retries will then equal the "max retries" parameter.

Or, to specify an infinite number of retries at the same rate, set the offline delay equal to the retry delay (max retries is not relevant in that case).

By default, these parameters are calculated internally, based on how the unit connects (LAN or modem) and, for modem connections, the event reporting period. This is indicated by "default" appearing as the value.

If you enter your own value for any of these parameters, that value will be used instead of the default calculation, regardless of connection mode.

Note: unless you have specific requirements, you should not need to set any of these parameters.

To restore the default settings, click on the **Restore DNP3 Defaults** button.

Appendix H. Connecting Sensors

The hydroSpider has two digital channels (DIN1 and DIN2) and two analogue channels (AIN1 and AIN2).

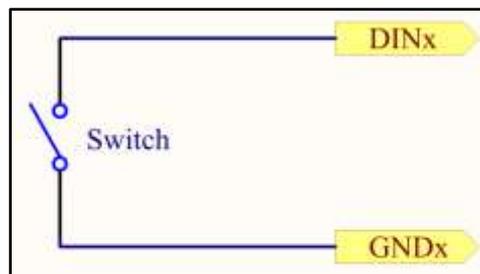
Digital channels are those which trigger on a transition from one state to another. All digital channels are based on the closing of a switch connected between a DINx pin and ground.

The hydroSpider2's analogue channels can each operate as either a voltage input or a pre-calibrated 4-20mA channel

The following sections discuss how different sensor types can be wired up to the hydroSpider.

Appendix H1. Switches

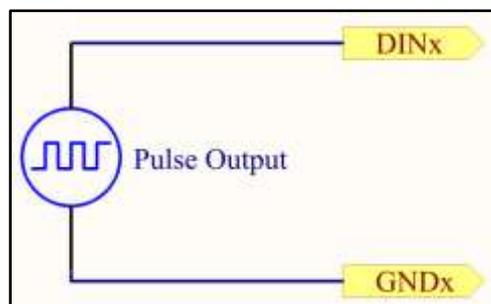
Switches are connected between a digital input pin and ground. When the switch closes for 3 seconds or more, the hydroSpider recognises a transition in the corresponding Switch channel. A diagram for connecting a typical switch to the hydroSpider is shown below.



For example: a switch is to be connected to digital input 2 of the hydroSpider. The switch should be wired between DIN2 and GND. When the switch closes, DIN2 will be shorted to ground and the hydroSpider will detect the switch closure after 3 seconds.

Appendix H2. Counters and event-type

Counter and Event channels make use of the hydroSpider's digital inputs. When the sensor pulses and shorts the digital pin to ground, the hydroSpider registers an event and acts accordingly. A diagram for connecting a pulse output to the hydroSpider is shown below.



For example: a flow meter is to be connected to digital input 2 as a Utility Meter. The flow meter must be wired between DIN2 and GND and the channel set up as a Counter type with the "Log difference in reading" feature enabled. The hydroSpider will detect the flow meter's pulses and increment the channel's count accordingly.

For example: a tipping bucket rain gauge is to be connected to digital input 1 as an Event channel. The rain gauge must be wired between DIN1 and GND and the channel set up with the Event type. The hydroSpider will detect the rain gauge's tips, record an event, and update the running total.

Appendix H3. Rotary / shaft encoders

Rotary encoders usually provide a "quadrature" output consisting of two phases. Each phase must be connected to a separate digital input.

Phase 1 must be connected to DIN 1 and Phase 2 connected to DIN 2

For example: The user wishes to connect a rotary encoder to the quadrature input. One phase must be connected to 'DIN 1', the other must be connected to 'DIN 2' and the ground may be connected to any available GND connection (note: all grounds are common).

Appendix H4. Difference counters

Some meters have two pulse outputs – one for the forward (or positive) direction, the other for reverse (or negative). Each must be connected to a separate digital input:

The Forward output must be connected to DIN 1 and Reverse connected to DIN 2.

Appendix H5. 4-20mA current loop sensors

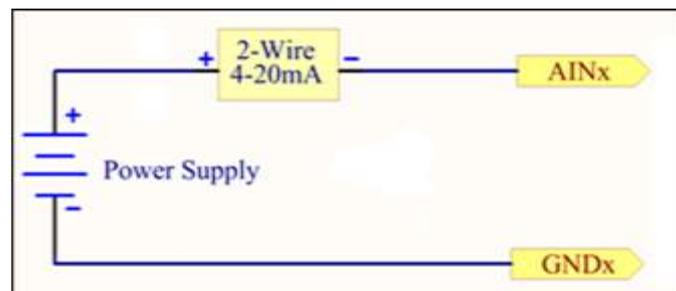
Current loop sensors communicate their data by outputting current which changes based on the sensor's measurements. 4-20mA sensors use 4mA to represent minimum measurement value, and 20mA to represent their maximum measurement value.

Each of the hydroSpider2's two analogue inputs (AIN1 and AIN2) can be used as a pre-calibrated 4-20mA channel. The sensor's output loop can be wired directly into either of the hydrospider2's AIN inputs.

4-20mA sensors commonly come in two varieties: 2-wire and 4-wire. Both of these types of sensors require power, which may be controlled by the hydroSpider's Switched Power Out control if required.

2-wire arrangement

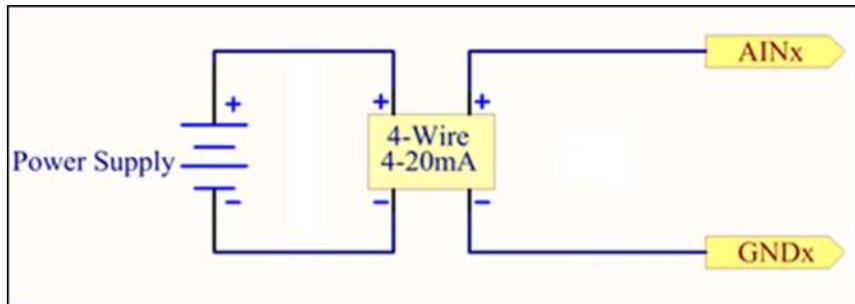
2-wire 4-20mA sensors draw power from their output loop. A diagram for connecting sensors of this type is shown below.



NOTE: no external resistor is needed when the 4-20mA input type is selected. These inputs contain an internal resistor and are pre-calibrated.

4-wire arrangement

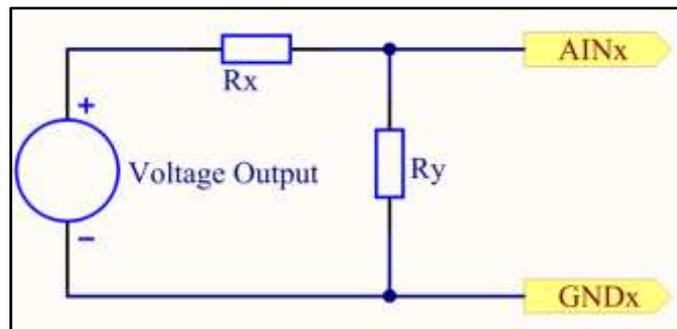
4-wire 4-20mA sensors have a separate power loop and output loop. A diagram for connecting sensors of this type to the hydroSpider is shown below.



NOTE: no external resistor is needed when the 4-20mA input type is selected. These inputs contain an internal resistor and are pre-calibrated.

Appendix H6. Voltage output sensors

Voltage output sensors communicate their data by outputting a voltage level which changes based on the sensor's measurements. Either of the hydroSpider's analogue inputs (AIN1 and AIN2) can be used for connecting sensors of this type.



The hydroSpider's analogue voltage inputs (AIN1 and AIN2) can produce readings for voltages between 0V and 2.4V.

If the sensor output is a voltage outside of this range, then two external resistors (forming a resistor divider) are often required to avoid the sensor going outside of the hydroSpider's range. Some common sensor ranges and their resistor values are given in the table below:

Sensor Range	Value of Rx	Value of Ry
0V – 2.4V	None required (short circuit)	Leave out (open circuit)
0V – 5V	1.2 kΩ 0.25W metal film	1 kΩ 0.25W metal film
0V – 10V	3.3 kΩ 0.25W metal film	1 kΩ 0.25W metal film

Appendix I. Report Formats

Report data is sent as a comma separated value (CSV) file, with the extension “.csv”. This is a very simple file type which can be opened using spreadsheet software (eg: Microsoft Excel), read directly with any text editor, or even easily parsed using custom software.

The hydroSpider has a number of report formats which can be selected to suit the application/user requirements. Each format is described below along with a sample snippet of the report format for illustration purposes.

Appendix I1. Report File Names

Reports files will be named to reflect the type of report, format of the data, and the date and time it was triggered:

- **Daily**
`<location>_<format>D_<date>.csv`
- **Periodic**
`<location>_<format>P_<date>_<time of trigger>.csv`
- **Requested (current day's data)**
`<location>_<format>A_<date>_<time of request>.csv`
- **Requested (previous data)**
`<location>_<format>A_<date report starts>.csv`

Where:

`<location>` is the first 18 characters of the hydroSpider's location name

`<format>` is the character representing the format of the report (R for raw, F for filtered, D for diagnostic, M for multi-column, S for user ID)

`<date>` is the date of the report in the format ddmmyy

`<time of trigger>` is when the report transmission was triggered in the format HHmm

`<time of request>` is when the report was requested by the user in the format HHmm

`<date x days ago>` is the date that the report starts from in the format ddmmyy

Note that spaces in the location part of the filename will be replaced by '-' characters.

For example: a raw daily report that was sent on the 6th December 2013 from a hydroSpider with location name 'my hydroSpider' will have the following name:

"my-hydroSpider_RD_061213.csv"

For example: a multi-column daily report that was sent on the 6th December 2013 at 12:00 from a hydroSpider with location name 'my HydroSpider' will have the following name:

"my-hydroSpider_MP_061213_1200.csv"

For example: a diagnostic report of the last 24 hours of data is requested from the hydroSpider. The hydroSpider has its location name set to "my hydroSpider", and the report was requested on the 6th December 2013 at 11:33am. The report's name will be:

"my-hydroSpider_DA_061213_1133.csv"

For example: a filtered report of the last 3 days of data is requested from the hydroSpider. The hydroSpider has its location name set to "my hydroSpider", and the report was requested on the 6th December 2013. The report's name will be:

"my-hydroSpider_FA_031213.csv"

Appendix I2. Raw Report Format

Raw reports contain the following columns:

1. Date in d/mm/yyyy format
2. Time in 24-hour h:mm:ss format
3. Primary identifier (see Appendix K)
4. Secondary identifier (see Appendix K)
5. Channel value or message

The raw report format is illustrated below with a sample snippet:

11/10/2012	0:42:41	6144	10001	EXITSETP	
11/10/2012	0:43:00	1	2	32	
11/10/2012	0:43:00	2	2	3.12	
11/10/2012	0:43:00	3	3	3469.99	
11/10/2012	0:43:00	4	3	11.844	
11/10/2012	0:43:00	5	3	7.34	
11/10/2012	0:43:00	7	3	33	
11/10/2012	0:44:00	1	2	32.37	
11/10/2012	0:44:00	2	2	3.62	
11/10/2012	0:44:00	3	3	3469.99	
11/10/2012	0:44:00	4	3	11.851	
11/10/2012	0:44:00	5	3	7.34	
11/10/2012	0:44:00	7	3	33	
11/10/2012	0:44:15	0	17	1	
11/10/2012	0:44:37	0	17	0	
11/10/2012	0:44:37	0	16401	22	

Sample raw report

Appendix I3. Diagnostic Report Format

The layout of data in a diagnostic report is identical to that of a raw report. Additional information is given for channels with "Log difference in reading" enabled. For these channels, diagnostic reports have an additional column which shows the running total value of that channel.

Diagnostic reports contain the following columns:

1. Date in d/mm/yyyy format
2. Time in 24-hour h:MM:ss format
3. Primary identifier (see Appendix K)
4. Secondary identifier (see Appendix K)
5. Channel value or message
6. Running total channel value (channels with "Log difference in reading" enabled only)

The diagnostic report format is illustrated below with a sample snippet. Take note of the 6th column for channel with channel ID 1, which shows this channel's running total:

11/10/2012	0:42:41	6144	10001	EXITSETP	
11/10/2012	0:43:00	1	34	32	302.65
11/10/2012	0:43:00	2	2	3.12	
11/10/2012	0:43:00	3	3	3469.99	
11/10/2012	0:43:00	4	3	11.844	
11/10/2012	0:43:00	5	3	7.34	
11/10/2012	0:43:00	7	3	33	
11/10/2012	0:44:00	1	34	32.37	335.02
11/10/2012	0:44:00	2	2	3.62	
11/10/2012	0:44:00	3	3	3469.99	
11/10/2012	0:44:00	4	3	11.851	
11/10/2012	0:44:00	5	3	7.34	
11/10/2012	0:44:00	7	3	33	
11/10/2012	0:44:15	0	17	1	
11/10/2012	0:44:37	0	17	0	
11/10/2012	0:44:37	0	16401	22	

Sample diagnostic report

Not shown above, diagnostic reports also provide a more detailed level of debugging compared to raw reports. Most applications won't require this additional debugging detail, but is of great use to Halytech if something unexpected happens with the hydroSpider-based system.

'Diagnostic Only' reports are formatted in the same way, but exclude the logged channel data. They contain only system messages and diagnostic codes that are useful to Halytech when resolving an issue.

Appendix I4. Filtered Report Format

Filtered reports contain the following columns:

1. Channel name
2. Date and time in *dd-mmm-yy hh:mm:ss* format
3. Channel value

Rainfall	25-Jun-14 14:19:23	1
Rainfall	25-Jun-14 14:19:44	1.1
Rainfall	25-Jun-14 14:19:44	1.2
Rainfall	25-Jun-14 14:19:45	1.3
Rainfall	25-Jun-14 14:19:53	1.4
Rainfall	25-Jun-14 14:20:00	1.5
Battery Voltage	25-Jun-14 14:20:00	11.842
Charger Voltage	25-Jun-14 14:20:00	0.006
System Temperature	25-Jun-14 14:20:00	23.4
Rainfall	25-Jun-14 14:20:08	1.6

Sample filtered report

There are a number of special cases for the channel name:

- When a Switch channel changes from ON to OFF, the number of seconds it was ON is also logged. This is recorded in the filtered report as *<channel name>_run*.
- Midnight log values are displayed in filtered reports as *<channel name>_reading*. For channels with "log difference" enabled, this will be the total channel count.
- If Min/Max logging is enabled on a channel, the maximum sampled value will be logged and displayed in filtered reports as *<channel name>_max*.
- If Min/Max logging is enabled for a channel, the minimum sampled value will be logged and displayed in filtered reports as *<channel name>_min*.

For example, look at the last row in the sample filtered report shown above. This row reads 'Float Switch_run', which indicates that the switch was ON for 22 seconds before turning back off.

Note that filtered reports don't contain any information, warning, or error messages.

Appendix I5. Multi-column Report Format

Multi-column reports consist of the following columns:

1. Date and time in d/mm/yyyy hh:MM format
2. One column for each channel
3. Modem signal strength

Below is a snippet of a sample multi-column report:

Time	Float Switch	Outlet Pipe 1	Outlet Pipe 2	Water Pressure	External Power	Internal Battery 1	System Temp	Modem Signal (%)
11/10/2012 0:43:00		32	3.12	3469.99	11.844	7.34	33	
11/10/2012 0:44:00		32.37	3.62	3469.99	11.851	7.34	33	
11/10/2012 0:44:15	1							
11/10/2012 0:44:37	0							

Sample multi-column report

Multi-column reports make it easy to view the data logged on each logging period. All of the records that were logged during the same second line up in the same row.

Observe that the Float Switch channel has blank cells in the first 2 data rows. This happens whenever there is no data for that particular second. Blank cells are a common occurrence for switches they only log when they change value, and not at a regular interval like the rest of the channels. Conversely, the next two data rows show the switch value changing to on and off, while the rest of the channels show blank cells.

Aligned multi-column reports have the same columns as standard multi-column reports. The difference is that all records in this type of report are moved to be reported on the closest general logging period timestamp.

This is useful if you have late-running sensors (eg: SDI-12, Modbus, etc) which cause normal multi-column records to have multiple rows per logging period.

For example: multiple registers are being read from an SDI-12 channel. Each of these channels take approximately 0.3 seconds to read. This means that SDI-12 channels 1-3 are logged at 06:00:00, channels 4-6 at 06:00:01, and channels 7-9 are logged at 06:00:02. In a standard multi-column report, this results in 3 disjointed rows produced per logging period. However, the aligned multi column report causes all of these records to be reported on a single line on the logging period time of 06:00:00. This results in a much easier-to-handle report file.

Note: this report format is not suitable for Switch and Event-type channels, as their records will also be moved from their actual activation time to the logging period time.

Appendix I6. User ID Report Format

The User ID report format makes use of the User-defined ID (rather than the Default ID) assigned to each channel. It has the following columns:

1. Date in d/mm/yyyy format
2. Time in h:MM:ss format
3. Identifier
4. Channel value or message

If the record is for an *Input*, the Identifier is the User ID selected by the user for that channel. Otherwise, this field will display the Identifier listed in Appendix K. For example, Modem Signal Strength (%) has identifier 100.

Note: to ensure that the identifier for each input is unique, include at least one letter (A-Z) in the channel's User ID, because system identifiers (such as modem signal strength) are purely numeric and do not include any letters.

The user ID report format is illustrated below with a sample snippet:

11/10/2012	0:42:41	402663185	EXITSETP
11/10/2012	0:43:00	PIPE_1	32
11/10/2012	0:43:00	PIPE_2	3.12
11/10/2012	0:43:00	PRES	3469.99
11/10/2012	0:43:00	EXT_PWR	11.844
11/10/2012	0:43:00	BATT	7.34
11/10/2012	0:43:00	TEMP	33
11/10/2012	0:44:00	PIPE_1	32.37
11/10/2012	0:44:00	PIPE_2	3.62
11/10/2012	0:44:00	PRES	3469.99
11/10/2012	0:44:00	EXT_PWR	11.851
11/10/2012	0:44:00	BATT	7.34
11/10/2012	0:44:00	TEMP	33
11/10/2012	0:44:15	F_SWITCH	1
11/10/2012	0:44:37	F_SWITCH	0
11/10/2012	0:44:37	F_SWITCH_run	22

Sample user ID report

Each of the channel identifiers (eg: PIPE_1, PRES) have been assigned to the channel separately from the channel's name.

Appendix I7. Custom Report Formats

Custom report formats have been developed to meet the requirements of specific customers.

Custom format 1

This report includes only counter channels with log difference enabled.

Each line in the report file consists of the following fields:

1. Long location
2. Channel name
3. Start datetime of log period in YYYY-MM-DD HH:MM format
4. End datetime of log period in YYYY-MM-DD HH:MM format
5. Difference in value over log period
6. Channel Units
7. Channel User ID

RID HTTP

This report format can be used to send data as HTTP GET requests to the Royal Irrigation Department's servers in Thailand.

The report will only include only input channels where the User ID has been set to RQ, signifying rainfall quantity, or WL, signifying water level.

Note that there can only be one rainfall input ("RQ") and/or one water level input ("WL").

The unit's short location name should be set to the station's site ID.

This report format is designed to be sent via HTTP, so HTTP should be always selected as the report delivery method for this format, and an HTTP server and path must be specified, for example "host.domain.com/datainput.php".

Appendix J. Alert Formats

Appendix J1. SMS alerts

SMS alert messages have the following format:

<location>: *<message>*

Where:

<location> is the configured hydroSpider location name

<message> is the configured message for this particular alarm

For example: A hydroSpider with location name 'myHydroSpider' has been configured with an alarm. This alarm has SMS alerts enabled, and has the message "Pump 1 has failed". When this alarm triggers, the following message will be sent to all SMS alert recipients of this alarm:

myHydroSpider: Pump 1 has failed

Appendix J2. Email alerts

Transmitted email alerts have the following format:

HYDROSPIDER at *<location>*
<message>

Generated by Alarm: *<alarm number>* (*<alarm name>*)

Where:

<location> is the configured hydroSpider location name

<message> is the configured message for this particular alarm

<alarm number> is the number of this alarm (1 to 8)

<alarm name> is the configured name for this particular alarm

For example: A hydroSpider with location name 'myHydroSpider' has been configured with an alarm. This alarm is called "Pump 1 fail", has email alerts enabled, and has the message "Pump 1 has failed". When this alarm triggers, the following message will be sent to all email alert recipients of this alarm:

HYDROSPIDER at myHydroSpider
Pump 1 has failed

Generated by Alarm: 1 (Pump 1 fail)

Appendix J3. Twitter alerts

Transmitted twitter alerts have the following format:

<alarm name>: *<message>* - sent from a Halytech hydroSpider on *<m/dd/yyyy>*,
<H:MM:ss>

Where:

<alarm name> is the configured hydroSpider location

<message> is the configured message for this particular alarm

<mm/dd/yyyy> is the date the hydroSpider sent the alert

<HH:MM:ss> is the time that the hydroSpider sent the alert in 24-hour format

For example: A hydroSpider has been configured with an alarm. This alarm is called "Pump 1 fail", has twitter alerts enabled, and has the message "Pump 1 has failed". When this alarm triggers, the following message will be tweeted:

Pump 1 fail: Pump 1 has failed – sent from a Halytech hydroSpider on 6/12/2013
09:23:45

In the above example, the hydroSpider's local date was 6/12/2013 and its local time was 9:23:45am when the tweet was sent.

Appendix K. Diagnostic and Raw Report Identifiers

This appendix enumerates the values of the primary and secondary identifiers found in diagnostic and raw report types.

Appendix K1. Inputs

Input records represent channel values.

Primary Identifier	Secondary Identifier	Value
Range: 0 to 999 Represents the channel which the data in this record belongs to	Range: 0 to 65535 Unique ID, built from channel type and data source There are four special cases: Analogue sampled minimum = 10000 + Unique ID Analogue sampled maximum = 20000 + Unique ID Switch On Time = 30000 + Unique ID (the amount of time a switch was on) Midnight Log = 40000 + Unique ID (if "log difference" is enabled this will be the total channel count or absolute value)	Input value

Appendix K2. System records

System records are logged when the hydroSpider performs an action of note.

Primary Identifier	Secondary Identifier	Value
1000	0 = Device turned on	
	10 = Internal code	SRAMRST
	11 = Internal code	SRAMUPG
	50 = Logfile erased	LOGERASE
	100 = Device restarting to install an upgrade	REBOOTRQ
	101 = Device restarting by user request	REBOOTRQ
	200 = Clock has been reset to factory default	CLKRST
	201 = Clock has been reset to latest time found in log file	CLKRST
	300 = Clock is about to be changed	CLKCHG
	301 = Clock has just been changed	CLKCHG
	400 = Software upgrade success	UPG OK
	401 = Software upgrade failed	UPG FAIL
	402 = Software upgrade cancelled – already running latest version	UPGNONEW
	500 = Configuration update over FTP was successful	CFG OK
	501 = Configuration update over FTP has failed	CFG FAIL
502 = Configuration update over web interface	CFG OK	

	was successfully	
	503 = Configuration update over web interface has failed	CFG FAIL
	1000-1999 = Input count was reset 1000 + Channel ID	INP RST
	2000-2999 = Input was calibrated 2000 + Channel ID	INP CAL
	3000-3999 = Input was calibrated remotely 3000 + Channel ID	INP RCAL
	10000 = Change Setup was entered	ENTRSETP
	10001 = Change setup was exited	EXITSETP
	10100 = LAN was turned on	LANON
	10101 = LAN was turned off	LANOFF
	60000 = Start or end of the separate diagnostic log area was reached. Diagnostic messages may have been logged beyond this point, but are no longer available.	START/END OF DIAGNOSTICS PARTITION

Appendix K3. Controls

Control records are logged when the state of a control changes.

Primary Identifier	Secondary Identifier	Value
Range: 2000 to 2999 2000 + Control # 2000 is Switched Power 2001 is Open Collector	0 = Output off	OFF CN#
	1 = Output on	ON CN#

Appendix K4. Alarms

Alarm records are logged whenever the state of an alarm changes (activation, deactivation, and acknowledgement) and when the alarm has something to report about the status of its alerts.

Primary Identifier	Secondary Identifier	Value
Range: 3000 to 3999 3000 + Alarm number	0 = Alarm activated	AL ACT
	1 = Alarm deactivated	AL DEACT
	2 = Alarm acknowledged	AL ACK
	3 = Alarm auto acknowledged	AL ATACK
	10000-19999 = Alarm SMS sent OK (100 x SMS number) + Attempt number	ALSMS OK
	20000-29999 = Alarm SMS failed (100 x SMS number) + Attempt number	ALSMS FL
	30000-39999 = Alarm email sent OK 30000 + Attempt number	ALEML OK
	40000-49999 = Alarm email failed 40000 + Attempt number	ALEML FL
	50000-50099 = Alarm tweet sent OK 50000 + Attempt number	ALTWT OK
	50100-50199 = Alarm tweet failed 50100 + attempt number	ALTWT FL

Appendix K5. Reports

Report records are logged whenever a report attempt has succeeded or failed.

Primary Identifier	Secondary Identifier	Value
Range: 4000 to 4999 4000 + Report #	10000 to 19999 = FTP report uploaded OK	R FTP OK
	10000 + Attempt number	
	20000 to 29999 = FTP report failed	R FTP FL
	20000 + Attempt number	
	30000 to 39999 = Email report sent OK	R EML OK
	30000 + Attempt number	
	40000 to 49999 = Email report failed	R EML FL
	40000 + Attempt number	

Appendix K6. Responses

The hydroSpider attempts to upload a file to the FTP server in response to a configuration or software upgrade. Response records are logged to show the status of response file uploads.

Primary Identifier	Secondary Identifier	Value
Range: 5000 to 5999 5000 is Upgrade 5001 is Setup	10000-19999 = Response FTP upload OK	RSPFTPOK
	10000 + Attempt Number	
	20000-20999 = Response FTP upload failed	RSPFTPFL
	20000 + Attempt Number	

Appendix K7. Modem records

Modem records are logged whenever the modem performs an action of note.

Primary Identifier	Secondary Identifier	Value
6000	0 = Modem turned on	MODEMON
	1 = Modem turned off	MODEMOFF
	100 = Modem signal strength (%)	Signal strength in %
	101 = Modem signal strength (dBm)	Signal strength in dBm
	102 = Modem signal strength (raw value)	Signal strength
	200 = GPRS connection failed	GPRSFAIL
	300 = Received SMS	Last 8 digits of the sender's phone number

Appendix K8. Services

Service records are logged to show the status of hydroSpider services when they are attempted.

Primary Identifier	Secondary Identifier	Value
7000	0 = NTP updated the system clock	NTP OK
	1 = NTP failed	NTP FAIL

Appendix K9. Internal Codes

The hydroSpider logs a variety of additional records which indicate its internal states. These are only useful to Halytech for diagnostic potential issues so aren't listed here.

Appendix L. Setup file format

Any setup file loaded into a hydroSpider must be formatted correctly. This section describes these requirements.

1. Header

The first three lines of the file must be:

```
.HYDROSPIDER2  
.DEV=<device code>  
.VER=<version number>
```

Where *<device code>* must match the hydroSpider's device type and *<version number>* must match or be less than the software version currently running on the hydroSpider. If the device code or version number is incorrect, the configuration file will be rejected.

The device codes for the various hydroSpider models are as follows:

Device Type	Device Code
hydroSpider2	40
hydroSpider2 (SDI-12 / RS-485)	41
hydroSpider2 (FlowShark / RS-232)	42

2. Body

All setup parameters which are to be changed should be listed on separate lines. If a parameter doesn't need to be changed from its current value, it can be left out of the setup file.

3. Footer

The file must end with:

```
.END
```

Appendix M. Power Considerations

Under typical conditions the hydroSpider2 can run for an extended period of time (up to 5 years) before requiring a battery replacement.

To achieve the lowest power consumption setup (and therefore the best battery lifetime), consider the following:

- The reporting period should be set to what the application requires, and no faster. The biggest power consumer in the hydroSpider is the internal modem. Reporting uses the modem, and therefore reporting more frequently has a dramatic effect on the power consumption of the unit.
- The logging period should be set to what the application requires, and no faster. More frequent logging generates larger reports, which require a longer time to be sent via the modem (and therefore consume more power). In addition to this, the act of logging itself consumes power, especially when the connected sensors require warm-ups.
 - If data (or faster logging of data) is only required under certain circumstances, consider using the Fast Logging feature of an alarm.
- Switch and Event channels log a record every time they change. Therefore these channel types are suitable for monitoring pulses that occur less frequently than once every 30 seconds. If logging of higher frequency pulses is required, it is recommended to choose either the Counter channel type.

Appendix N. Troubleshooting

Problem: I cannot connect to my hydroSpider

1. Make sure that you are powering the hydroSpider with 12V into its *BATT* port, or with a 16V-24V charger supply connected to its *Charger* port. Double check that the power polarity is correct. See 2.6.2 - Connecting power.
2. Ensure that both the USB cable and Ethernet cable are plugged into your computer, and that the Comms-end of the LAN link cable is plugged into the hydroSpider.
3. Your browser settings may be preventing the connection to the hydroSpider's web interface.
 - a. Disable automatic dialing: In IE8, go to Tools -> Internet Options -> Connections, and then select "Never dial a connection".
 - b. Disable proxy servers: In IE8, go to Tools -> Internet Options -> Connections -> LAN Settings, and uncheck "Use a proxy server for your LAN"
 - c. If you changed any browser settings, close and restart your browser.
4. Your network settings may be preventing connection to the hydroSpider's web interface.

For Windows XP, perform the following actions:

- a. Click on "Start"->"All Programs"->"Accessories"->"Communications"->"Network Connections"
- b. If in the newly opened window if you don't have an item called "Network Bridge" go to step 3.
If you do, right click on it and select "Properties". Go to step 4.
- c. Right click on the item "Local Area Connection" and select "Properties".
- d. Near the bottom of the new window click on "Internet Protocol (TCP/IP)" and then click on "Properties"
- e. Select "Obtain an IP address automatically"
- f. Select "Obtain DNS server address automatically"
- g. Click OK
- h. Click OK
- i. Close the Network Connections window

For Windows 7, perform the following actions:

- a. Click on the 'Start' icon->"Control Panel"->"Network and Internet"->"Network and Sharing Center"->"Change Adapter Settings"
- b. If in the newly opened window if you don't have an item called "Network Bridge" go to step 3.
If you do, right click on it and select "Properties". Go to step 4.
- c. Right click on the item "Local Area Connection" and select "Properties".
- d. Near the bottom of the new window click on "Internet Protocol (TCP/IP)" and then click on "Properties"
- e. Select "Obtain an IP address automatically"
- f. Select "Obtain DNS server address automatically"
- g. Click OK
- h. Click OK
- i. Close the Network Connections window

Problem: I cannot log into the hydroSpider

1. Check that both your username and password are correct. By default, the username is "user" and the password is "changeme".
2. Check that Caps Lock is not enabled when you are typing in the password.
3. Ensure that you are logging in to the correct unit by checking the MAC address at the bottom of the Log In page with the unit's serial number.
4. Please contact Halytech for further assistance.