microSpider2 Environmental

microSpider2 Industrial

microSpider Lite

Ultra Low Power Telemetry, Logging and Alarm System

USER MANUAL

microSpider2 User Manual Version 1.26
Copyright © Halytech

SOFTWARE LICENCE AND COPYRIGHT NOTICE

Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Halytech
ABN 51 094 853 068
PO Box 6983
Baulkham Hills Business Centre
NSW 2153 Australia
Tel: +612 8814-5235
E-mail: sales@halytech.com.au
www.halytech.com.au

Table of Contents

Preface

This user manual covers the Halytech microSpider2 Industrial, Environmental and Lite. When the term microSpider2 is used it means all variants, for variant specific instructions and information the full variant name will be used.

This document is ordered in the recommended sequence for configuring a microSpider2.

Each section is arranged 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	30/09/2015	Developed from microSpider Mk1
V1.01	02/02/2016	Updated with microSpider2 (v1.15 firmware) specifics
V1.02	23/02/2016	Updated to v1.16 firmware
		Added warning re using '\' in SMS commands
		Clarified ground pin usage
V1.03	04/03/2016	v1.17 firmware changes
V1.04	21/11/2016	v1.26 firmware, including DNP3
V1.05	12/01/2017	Updated to v1.29 firmware
		Added remote access appendix
V1.06	19/01/2017	Updated SMS commands
V1.07	07/03/2017	Added advanced DNP3 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	30/11/2017	Added log positive differences only
V 1.15	19/12/2017	Added RID HTTP report format
		Updated remote access
V 1.16	14/08/2018	v1.49 firmware
V 1.17	21/08/2018	Added remote SMS control of other devices
V 1.18	19/09/2018	v1.51 firmware
V 1.19	08/10/2018	v1.52 firmware
V 1.20	06/11/2018	Added integration and evapotranspiration
V 1.21	11/06/2019	Added periodic alarms
V 1.22	24/07/2019	V1.64 firmware (logging changes)
V 1.23	07/11/2019	Added SWL and parameter channels
V1.24	09/12/2019	Added microSpider Lite information
V1.25	17/12/2019	Added DPIE Appendix

Introduction

The Halytech microSpider2 is an integrated monitoring, control and alarm system designed for remote, low power, battery powered applications.

It can monitor various inputs, control outputs, generate alarms and log. microSpider2 is a complete system. It includes all software, hardware, a cellular phone module and batteries. Setting up and interrogating a microSpider2 is a simple matter of viewing pages with any standard web browser.

NO SOFTWARE MODIFICATIONS ARE REQUIRED TO CATER FOR DIFFERENT APPLICATIONS.

microSpider2 is suitable for use by system integrators and OEM applications. Three microSpider2 variants are available - "microSpider2 Environmental", "microSpider2 Industrial" and the "microSpider Lite". The differences between the variants are described later.

Typical Applications

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

System Overview

Each microSpider2 incorporates an input/output interface, a logger and a 4G/3G cellular phone interface.

microSpider2 Variants

The microSpider2 is available in three models:

1. microSpider2 Environmental (waterproof, self-powered)
2. microSpider Lite (compact, waterproof, self-powered)
3. microSpider2 Industrial (DIN rail mountable, external power required)

The microSpider2 Environmental and microSpider Lite can be supplied in one of two antenna configurations:

1. An internal antenna which is housed inside the IP68 enclosure.
2. An antenna port which is accessed outside the enclosure and must be connected to an external antenna.

The microSpider2 Environmental supports a second optional internal battery pack to extend the battery life.

The microSpider2 Industrial is fitted with an internal charging circuit, providing a complete power solution supporting mains and/or solar chargers and an external rechargeable battery. No external solar regulators or similar are required.

NOTE: The variants and their options must be specified at order time.

General capabilities

microSpider2 Industrial and Environmental units are capable of:

1. Monitoring up to twenty (20) inputs. These can be any combination of:
   - up to 8 native user inputs
   - up to 6 system inputs (Battery Voltages, External Power, Charger Voltage, System Temperature and Moisture Detector
   - up to 20 intelligent inputs e.g. SDI-12 or Modbus using an external interface
2. Controlling up to three (3) controls

The microSpider Lite is capable of:
limited to monitoring up to eight inputs and to 2 outputs.

1. Monitoring up to eight (8) inputs. These can be any combination of:
   - up to 8 native user inputs
   - up to 3 system inputs (Battery Voltage, System Temperature and Moisture Detector)
   - up to 8 intelligent inputs e.g. SDI-12 or Modbus using an external interface
2. Controlling up to two (2) controls

All microSpider2 units are capable of
1. Generating up to sixteen (16) alarms
2. Sending SMS messages
3. Sending e-mails
4. Logging input, control and alarm activity
5. Sending automatic daily reports via e-mail, FTP and/or HTTP
6. Being configured by the user through a standard web browser
7. Downloading and installing software updates and setup changes via FTP

Inputs

The microSpider2 Native inputs allow switch, voltage and current sensors to be connected directly into the microSpider2.

Native inputs are connected to the microSpider2 via input/output (I/O) connectors. Inputs can be configured by the user for operation in one of the following modes:

1. "SWITCH" – switch closure or voltage free contact.
   Switch inputs detect either an active (or "ON") state or an inactive (or "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. Every switch change (ON or OFF) is logged with the time of its occurrence.

   NOTE: There is no galvanic isolation between different inputs or the microSpider2 internal circuitry.

2. "COUNTER"
   The count will increment each time the input and ground terminals are shorted. Frequencies up to 100Hz are supported. The counter will roll-over from 999,999 to 0.

3. "ANALOGUE"
   Analogue inputs are used to monitor industrial sensors such as voltage, current,

temperature, pressure etc.
Most common sensor types are supported, including:

> 0 – 20 mA sensors
> 4 – 20 mA sensors
> 0 – 2.5V sensors
> 0 – 5V sensors
> 0 – 10V sensors

NOTE: All analogue signals share a common ground

4. "EVENT"
Event inputs are used to record occurrences of pulses. A pulse is generated by temporarily shorting the input and ground terminals together. Minimum acceptable pulse width is 10 ms. Event inputs are suitable for monitoring pulses that occur less frequently than once every 30 seconds. Each time an event occurs, the microSpider2 logs the time of its occurrence as well as the total number of events recorded since the event count was last reset. The total will roll-over from 999,999 to 0.

NOTE: Battery life will be dramatically reduced if a higher frequency signal is connected to an event input.

NOTE: Counter and event inputs both count pulses. The difference is that event inputs generate a log entry every time an event occurs, while counter inputs only log the count once per logging period (see section on logging, later).

Counter and event inputs can both be set up to record the number of pulses in a defined period, via the "Log difference in reading" or "Periodic reset" features (described later). This is useful for generating a daily total, used for example with a tipping bucket to record a daily rainfall total, or utility metering, which is typically used to record readings from water, electricity and gas meters.

5. "QUADRATURE"
The Quadrature Input can be used to connect the microSpider2 to a Rotary/Shaft Encoder. This requires the use of two input channels.
Quadrature inputs can produce both positive and negative values with the count rolling over from 999,999 to -999,999.
This roll-over works in both directions, so if the count is decremented past -999,999 it will wrap around to 999,999.

(Note: Scaler may be setup through Input Calibration and will be 1 by default.)

6. "DIFFERENCE"
The Difference input is used to record the difference between two counter inputs and therefore requires two input channels. The value reported is the number of pulses counted on one input (such as Digital 1) minus the pulses counted on the other input (such as Digital 2). Difference can produce both positive and negative values with the count wrapping around from 999,999 to -999,999 and, if being decremented, from -999,999 to 999,999.

A typical use for Difference is for connecting to bi-directional utility meters with separate forward and reverse outputs.

7. "DISABLED"
This mode disables the input. The input is removed from all reports and menus.
Please refer to **Appendix A: microSpider2 Inputs** for a summary of native input types, their specifications and typical uses.

The microSpider2 Industrial and Environmental can also be connected to "intelligent inputs".

These are SDI-12 or Modbus sensors (or a mixture of both) which connect via an external SDI-12 or RS-485 hardware interface, available from Halytech.

For more information, see 'Intelligent Sensors', below.

The user can tailor the system by assigning application specific input names. So, for example, Input 1 may be called "Water Level" etc.

All input types may be logged and/or used to trigger alarms.

Sampling Period:

Analogue and intelligent input types may be configured with a Sampling Period. This is the period at which the analogue channel is read (sampled).

The average of all the samples taken within each logging period can be logged. This is useful for smoothing out natural variation or noise in the raw readings, reducing the impact of outliers in the logged values.

Alternatively, the samples can be integrated over the logging period. This can be used, for example, to convert a flow rate into a volume, or power readings into accumulated energy.

Note: Sampling will only occur when the sampling period is less than the logging period. If both periods are the same, then microSpider2 will simply log every sample.

Min / Max:

If a channel is configured to have a sample period which is less than the logging period, you may enable Min / Max logging.
This will log the minimum and maximum sampled values in each logging period, along with the time they were recorded and a unique identifier so that they are not confused with the averaged or integrated value.

Example: 1 minute sample period, 3 minute log period, with averaging selected.

Time	Sampled Value
12:31:00	114.15
12:32:00	115.15
12:33:00	112.15

At the end of the logging period the average will be logged: 113.816

With Min / Max enabled, the minimum and maximum values will also be logged where min= 112.15, max= 115.15

The Min / Max values will be logged with additional 'identifiers' in the logfile to clearly distinguish them from other records.
In the Raw / diagnostic report format, the 'Identifier Column' will contain the Unique Channel Type ID + 10000 (minimum), or + 20000 (maximum)

In the Filtered report format, the records name will be: [channel name]_min or [channel name]_max.

Note: Min / Max values will not appear in Multi-Column reports.

System Monitors

microSpider2 Environmental is fitted with 6 System Monitors:

1. **External Power Voltage**: measures the voltage of an external power supply connected to the EXTERNAL POWER IN pin
2. **LAN Power Voltage**: measures the voltage of USB power connected (via an optional LANlink cable) to the communications connector
3. **Battery 1 Voltage**: measures the voltage of an internal battery connected to battery connector 1
4. **Battery 2 Voltage**: measures the voltage of an internal battery connected to battery connector 2
5. **System Temperature**: measures temperature inside the microSpider2 enclosure
6. **System Moisture**: detects if moisture is present on the main circuit board. This input can be helpful in preventing damage due to exposure to moisture for prolonged periods of time.

microSpider Lite is fitted with 3 System Monitors:

1. **System Temperature:** measures temperature inside the microSpider Lite enclosure
2. **Battery Voltage**: measures the voltage of the internal battery
3. **System Moisture**: detects if moisture is present on the main circuit board. This input can be helpful in preventing damage due to exposure to moisture for prolonged periods of time.

microSpider2 Industrial is fitted with 4 System Monitors:

1. **External Power Voltage**: measures the voltage of an external power supply or battery connected to the BATTERY / EXTERNAL POWER IN connector
2. **LAN Power Voltage**: measures the voltage supplied to the LAN port, either from an external power supply or the USB connector
3. **Charger Voltage**: measures the voltage of an external power supply or solar panel connected to the CHARGER IN connector
4. **System Temperature**: measures temperature inside the microSpider2 enclosure

System monitors can be used in the same way as inputs, i.e. they may be logged and/or used to trigger alarms.

Controls

microSpider2 Industrial and Environmental provide three controls, plus SDI-12 commands.

1. "SWITCHED POWER OUT"
   This can be used to power sensors from an external power supply connected to "EXTERNAL POWER IN". The microSpider2 will switch the power to the sensor when required.

   NOTE: If an external power supply is connected to a microSpider2 Environmental, it will also power the microSpider2 in preference to its internal battery pack as long as its voltage is above approximately 7.5V

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 GROUND through a 440 Ohm resistor.

3. "LOW VOLTAGE OUT"
   When activated, this output will provide either a 3.3V or 5V (user selectable) output which may be used to power low-power sensors. It can supply current up to approximately 100mA

4. "SDI-12 COMMAND"
   On activation and/or deactivation, this control sends a custom text string over SDI-12. 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.

microSpider2 Lite does not have "SWITCHED POWER OUT"

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 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.

Each control has the following two settings:

1. Custom name: a name given to this control so it can be easily identified on other pages (e.g.: "Pump Control" or "Sensor Power").

2. 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, typically the time that a sensor takes until its reading stabilises.

Some controls also have additional settings:

- Low Voltage Out

    o Voltage: Selectable between 3.3V and 5.0V output.

- SDI-12 Command

    o On command: command string to send over SDI-12 when the control activates.

    o Off command: command string to send over SDI-12 when the control deactivates.

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.

Intelligent Sensors

The user can connect up to 20 SDI-12 or Modbus (RS-485) Sensors (or a mixture of both) via the microSpider2 Intelligent Interface (II-ENV or II-IND, available separately from Halytech) that connects to I/O Port 1 or 2

When an Intelligent Interface is connected to I/O Port 1, Digital inputs 1 and 2 (DIN1 & DIN2) and Analogue inputs 1 and 2 (AIN1 & AIN2) will not be available for use as general inputs. Similarly, when an intelligent interface is connected to I/O Port 2, the DIN3, DIN4, AIN3 and AIN4 inputs will not be available for general use.

Both SDI-12 and Modbus (RS-485) sensors can be daisy-chained to the Intelligent Interface. Each sensor needs to have a unique address so that it can be talked to independently of the other sensors.

SDI-12 sensors must be powered. The following diagram shows a suggested connection method for SDI-12 sensors.
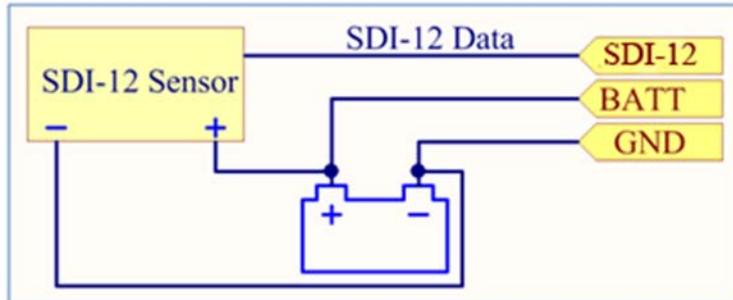
Additional sensors should all have a common ground connection, and can share the SDI-12 Data line by connecting in parallel.

SDI-12 and Modbus (RS-485) devices can be selected as inputs, in the same way as native inputs such as switch, analogue or counter inputs:

The input channels can be made up of any combination of native inputs, system monitors (Battery Voltage, System Temperature, etc.) and Intelligent SDI-12 / Modbus-485 inputs, as required. Since the microSpider2 can perform both SDI-12 and Modbus-485 concurrently, you can configure some intelligent input channels to be SDI-12 and others to be Modbus.

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 microSpider2 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 microSpider2 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.

To edit the settings, click on the options icon (the "cog") for the intelligent sensor input in the "Change Input Setup" page, in the same way as for other inputs. These inputs do however have some additional options available, as show 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 microSpider2 requires a different device address.

Command: microSpider2 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 microSpider2 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):

0D0!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.

If you require additional debugging, or want to change sensor parameters or the sensor address, the microSpider2 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.

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:

Examine Channel

Channel reading

Updating...

φ Update

Interactive Command

↵ **Send Command**

Close

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 microSpider2. 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 microSpider2 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 microSpider2.

Test Sensor Configuration: when this button is pressed, the microSpider2 will attempt to read the sensor, using the above settings. The **Diagnostic Trace** window (open it by clicking on the '[+]') shows the data sent and received, and any error messages.

Note: the *baud rate*, *parity* and *stop bits* settings of the Modbus-485 interface can be changed in Advanced Settings, although the default settings (baud rate = 19200, parity = even, stop bits = 1) will work with most Modbus-485 sensors and you will not need to change it.

External GPS (requires External GPS Software Option)

External GPS allows the user to connect an external GPS module to the microSpider2 so that it may log its position and/or send position information with alarms. This is useful for asset tracking, monitoring of vehicles, or theft / vandalism detection. External GPS hardware must be purchased in order to use this feature (GPS-ENV or GPS-IND).

For more information on the External GPS software or hardware, please contact Halytech.

Alarms

A microSpider2 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.

- **Send report(s)**: alarms can send out reports over email and FTP.

- **Turn controls on and off**: controls can be turned on, turned off, or pulsed.

- **Log a channel**: an additional input can be logged whenever an alarm is triggered.

- **Change the logging rate**: the microSpider2 can log faster for the duration of an alarm.

Each alarm can be programmed with a name, trigger source, 3 separate SMS telephone numbers, 3 e-mail addresses, the text of a message and the control to be activated. When the trigger becomes active, the alarm is triggered and the alarm sequence starts.

Alarms are completely independent from inputs. So, for example, an input can trigger more than one alarm, each of which will send its own special SMS to its own special telephone numbers.

After an alarm triggers (and sends SMS(s), reports, e-mails and/or tweets, as required), the microSpider2 will not re-trigger the same alarm until both of the following have occurred (in any order):

1. Alarm has been acknowledged (see 'Alarm acknowledgement' below) AND
2. The trigger input goes to inactive level and then back to active level

SMS sending

If SMS sending is enabled, an SMS with the programmed text is sent to all telephone numbers simultaneously.

If sending is not successful, due to network congestion for example, the SMS(s) will be retried after 1 minute. Up to three attempts are made.

E-mail sending

If e-mail sending is enabled, an e-mail with the programmed text is sent simultaneously to up to three addresses.

If sending is not successful, it will be re-tried after 3 minutes. Up to three attempts are made.

Tweeting

If Tweeting is enabled, a tweet with the programmed text is tweeted to Twitter (set as the user status).

If sending is not successful, it will be re-tried after 3 minutes. Up to three attempts are made.

Control activation and deactivation

Alarms can also be used for intelligent control of various systems.

For example, a tank level can be maintained by monitoring a water level and controlling a pump. One alarm is set to trigger when the water level falls below a low level. This alarm is configured to activate a control output, which in turn switches on the pump. A second alarm is set to activate when the water level is above a high level. This second alarm is configured to

deactivate the same control, in turn switching the pump off. Thus, the tank level is automatically kept between the two levels.

Alarm acknowledgement

Active alarms can be acknowledged in up to three different ways:
1. By accessing the "Alarms" page with a browser and clicking on the unacknowledged alarm
2. By using the "Auto Acknowledge" feature, where the microSpider2 automatically acknowledges the alarm after an amount of time.
3. (*Only available with the LiveSMS software option*): By sending an SMS to the microSpider2.

(Please see "Alarms" section for more details).

If an alarm is acknowledged but its trigger source is still in the active state, a new alarm sequence will NOT commence. Rather, the microSpider2 will wait for the trigger source to first go inactive.

Logger

microSpider2 incorporates a very high capacity solid-state data logger. The logger stores data into non-volatile memory, maintaining its contents in the event of a total power supply failure. All records are date/time stamped to a resolution of one second.

microSpider2 logs:

1. Input changes
2. System monitor changes
3. Control changes
4. Intelligent Sensors (requires Hardware Interface).
5. Alarm activations and resets
6. SMS transmissions and their outcomes
7. SMS command reception
8. E-mail, FTP and HTTP transmissions and their outcomes
9. System messages

Switch inputs automatically log an input change. If a switch input is initially in the "OFF" state and then goes "ON" for some time and then back to "OFF", both state changes are logged.

Event inputs automatically log a single record per pulse. If an event input is initially in the "OFF" state and then goes "ON" for some time and then back to "OFF", only a single record is logged.

All other channel types, including analogue inputs, counter inputs, system monitors and intelligent inputs, log at a regular interval (called the *logging period*), which can be specified individually for each channel.

These inputs can be logged using the "Minimum change required to log" method. The user specifies the minimum logging period and the minimum change that needs to be logged. For example, the logging period may be set to 1 hour and the minimum change to 100. The input will be checked every hour and logged if it has changed by 100 or more from the last logged value.

If logging of an analogue input, a counter input or a system monitor is enabled, it will be logged automatically every midnight. This ensures that at least one sample is recorded every day, even with slowly varying inputs.

Another option, available for every input type except switches, is to log only the difference in the reading since the last log entry. For example, if a counter is setup to log every 1 hour and

the count is 100 at the start of the hour and 105 at the end of the hour, the change is 5 in that hour and if "Log difference in reading" is enabled, the value logged would be '5'.

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

Please refer to Appendix A for a summary of input types and their typical uses.

Automatic reports

A microSpider2 can be set up to send periodic reports via e-mail, FTP, HTTP, HTTPS

E-mail reports are sent to up to three recipients.
FTP reports are sent to up to two user-specified FTP servers (or two accounts on one server).
HTTP reports are sent via HTTP POST to a user-specified HTTP address.

Each report is a spreadsheet (.csv) file containing data logged over the required period.

The advantage of automatic reports is in the microSpider2's ability to automatically deliver logged data without any user intervention.

Web Server

A sophisticated web server is built into every microSpider2.

It allows users to communicate with a microSpider2 using the familiar "Internet surfing" approach. You can use any computer regardless of type and operating system to connect to a microSpider2. NO SPECIAL SOFTWARE is required.

The web server is used for:

1. Setting up a microSpider2 for the first time
2. Viewing Inputs and System Monitors
3. Controlling Outputs
4. Viewing and resetting alarms
5. Downloading logged data
6. Software upgrades
7. Providing on-page help, which includes much of this manual.

All operations are performed by accessing simple web pages.

Supported Browsers

microSpider2 supports the current versions of the following Internet Browsers (other browsers may also work):

Internet Explorer 11
Microsoft Edge
Google Chrome

NOTE: your browser will need JavaScript enabled.

Physical Connections (microSpider2 Environmental)

Normally, a new microSpider2 is shipped without a SIM card and with the main battery disconnected from the circuit.

You need to open up the microSpider2 to insert a SIM card and to connect the battery.

Opening the microSpider2 Environmental

Undo the 4 screws holding the two halves of the microSpider2 case together. Carefully separate the two halves, taking care not to put any strain on the cables connecting the two halves.

SIM Card Installation

You need a SIM card to send SMS and to receive automatic reports from your microSpider2.

Halytech can provide fully functioning SIM cards for you.

If you want to source your own SIM card, contact your preferred mobile phone carrier and ensure that the SIM card is provisioned with a plan enabling internet data access.

To install a SIM card:

1. Put the SIM card in a standard mobile phone and disable any PINs
2. Open up the microSpider2 as described earlier in this chapter
3. Remove the metal bar protecting the circuit board by gently lifting it out of the grooves.
4. If connected, disconnect the battery from the circuit board by squeezing the locking latch and gently pulling the connector upwards.

5. Insert the SIM card into the holder.
    microSpider2 units are fitted with two different type of SIM card holders. They are
    easily distinguishable by the colour of their cover - either black of silver. Please follow
    the instructions relevant to the type of SIM card holder installed in your unit.

    If your microSpider2 is fitted with a **BLACK** SIM card holder:

    a. Slide the SIM card cover holder to the "OPEN" position
    b. Lever it upwards on its hinge to open it.
    c. Slide the SIM card into the groove of the cover, observing the proper notch
        orientation.
    d. Close the cover and slide the cover into the "LOCK" position.

a.

b.

c.

d.

If your microSpider2 is fitted with a **SILVER** SIM card holder:

    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.

6. If disconnected, re-connect the antenna lead and the battery lead power as described later in this document.
7. Replace the metal bar protecting the circuit board by inserting it into the case grooves.
8. Close the microSpider2 as described later in this chapter.

Connecting Antenna and Battery

1. Open up the microSpider2 as described earlier in this chapter
2. Connect the antenna by pressing the flying lead connector squarely onto the gold circuit board antenna connector until it "clicks-in".

3. Connect the battery lead by pushing it onto a free battery connector on the circuit board (usually BATT1) until it clicks into place.
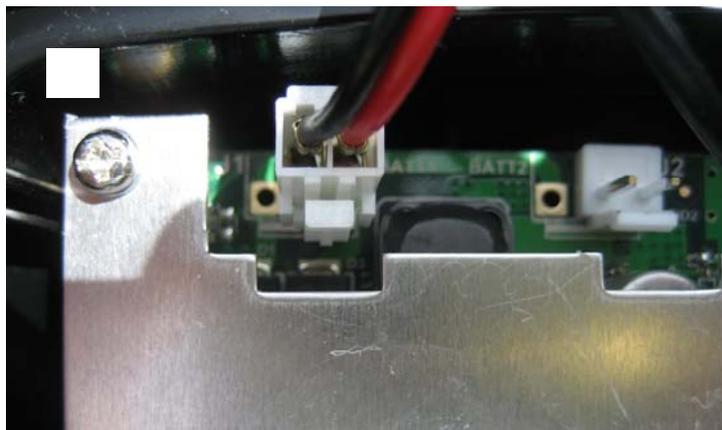
4. EXTERNAL ANTENNA UNITS ONLY

    These units are fitted with an SMA male connector on the top of the case. Once the external antenna is connected, it is recommended to seal the connection by using self-vulcanising rubber tape.
5. Replace the metal bar protecting the circuit board by inserting it into the case grooves.
6. Close the microSpider2 as described later in this chapter.

Closing the microSpider2 Environmental

Make sure that the O-ring is placed correctly into the groove of the battery half of the case. Re-assemble the two halves and redo the four screws. Do not over-tighten

NOTE: A video clip showing the case assembly is available at
www.halytech.com.au/images/downloads/microspider/o-ring.wmv
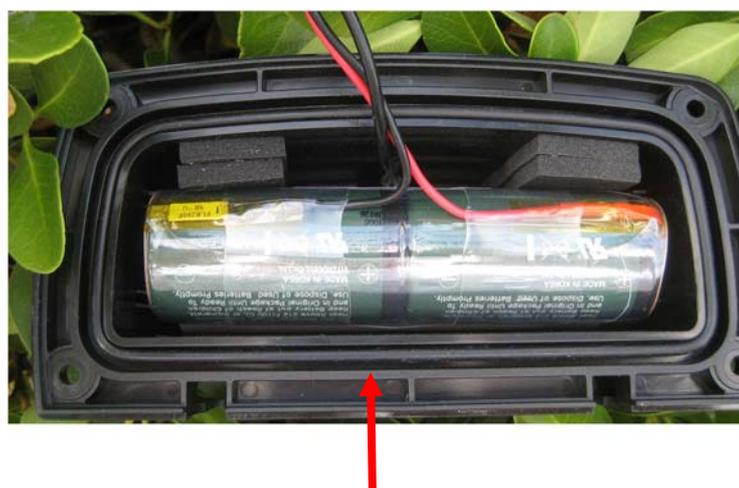
Inputs and Outputs Connectors

I/O CONN 1   I/O CONN 2

CONNECTOR BACK (SOLDER) END VIEW

Pin numbers are as shown above, when looking at the back (solder end) of the connector with the notch facing upwards. Both connectors have identical pinouts**.**

I/O CONNECTOR 1

PIN	NAME	FUNCTION	COMMENT
1	DIN1	SWITCH 1 / COUNTER 1 / QUADRATURE 1A	Active is short to GROUND
2	AIN1	ANALOGUE 1	0 – 2.4V or 4-20 mA range
3	GND	GROUND	
4	DIN2	SWITCH 2 / COUNTER 2 / QUADRATURE 1B	Active is short to GROUND
5	AIN2	ANALOGUE 2	0 – 2.4V or 4 - 20 mA range
6	GND	GROUND	
7	PWR OUT	SWITCHED POWER OUT	Driven by CONTROL 1, max 1A
8	PWR IN	EXTERNAL POWER IN	Nominal 12V 1A DC

I/O Connector 1 is located in the middle of the case.

I/O CONNECTOR 2

PIN	NAME	FUNCTION	COMMENT
1	DIN3	SWITCH 3 / COUNTER 3 / QUADRATURE 2A	Active is short to GROUND
2	AIN3	ANALOGUE 3	0 – 2.4V or 4-20 mA range
3	GND	GROUND	
4	DIN4	SWITCH 4 / COUNTER 4 / QUADRATURE 2B	Active is short to GROUND
5	AIN4	ANALOGUE 4	0 – 2.4V or 4-20 mA range
6	GND	GROUND	
7	OC OUT	OPEN COLLECTOR OUTPUT	Driven by CONTROL 2, nominal 10 mA
8	LV OUT	INTERNAL LOW VOLTAGE SENSOR POWER SUPPLY	User selectable as 3.3V or 5V supplied by internal battery, max 100 mA

I/O Connector 2 is located on the right hand side of the case when viewed from the front.

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

Protecting Connectors

Prior to leaving a site, you must ensure that any unused I/O connector and the communications connector are fitted with supplied sealing caps to prevent contact contamination.

Power Sources

microSpider2 does not have an On/Off switch. The unit starts operating as soon as power is applied.

microSpider2 incorporates a sophisticated power management system which allows power to be provided from multiple sources:

1. Internal Batteries. The included internal battery/batteries will power all aspects of the microSpider2 for several years under normal operation. They are non-rechargeable batteries.
2. Power may be provided from an external power supply when connected to the 'External Power In' on I/O Connector 1. When connected, this supply will be used instead of the batteries, saving battery power. The power provided should be nominal 12V DC and must be capable of supplying a minimum of 1A.
   Note: As the internal batteries are non-rechargeable, external power cannot recharge internal batteries.
3. When connected locally to a computer (see Appendix F1), the microSpider2 Environmental will use the PC's power supply for all operation other than powering the modem. Therefore, the device can be connected to the computer for extended periods of time without draining the internal batteries.

   Note: USB power must be connected to the microSpider2 Environmental in order to use the Web Server.

Physical Connections (microSpider2 Lite)

Normally, a new microSpider Lite is shipped without a SIM card and with the battery disconnected from the circuit.

You need to open up the microSpider Lite to insert a SIM card and to connect the battery.

Opening the microSpider Lite

See Opening the microSpider2 Environmental above

SIM Card Installation

You need a SIM card to send SMS and to receive automatic reports from your microSpider Lite.

Halytech can provide fully functioning SIM cards for you.

If you want to source your own SIM card, contact your preferred mobile phone carrier and ensure that the SIM card is provisioned with a plan enabling internet data access.

To install a SIM card:

1. Put the SIM card in a standard mobile phone and disable any PINs
2. If connected, disconnect the battery from the circuit board by squeezing the locking latch and gently pulling the connector upwards.
3. Unlock the SIM holder

4. Insert the SIM card into the card slot, gold contacts on bottom and notched end in first, until it "clicks" into place.
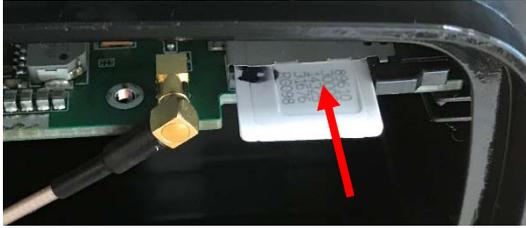
5. Using your finger nail, gently slide the SIM card switch to the "LOCKED" position. The switch only moves a couple of mm.
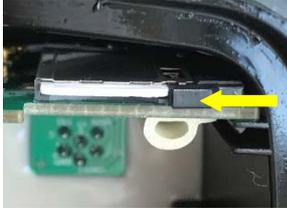
6. If disconnected, re-connect the antenna lead and the battery lead power as described later in this document.
7. Close the microSpider2 as described later in this chapter.

Connecting Antenna and Battery

1. Connect the antenna by pressing the flying lead connector squarely onto the gold circuit board antenna connector until it "clicks-in".

2. Connect the battery lead by pushing it onto the battery connector on the circuit board until it clicks into place. The battery slides into the case behind the circuit board. (To disconnect the battery, press the white tab and pull the connector off.)
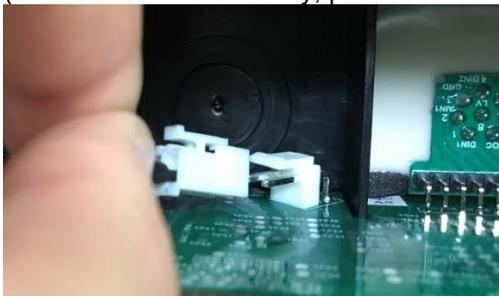
7. EXTERNAL ANTENNA UNITS ONLY
These units are fitted with an SMA male connector on the bottom of the case. Once the external antenna is connected, it is recommended to seal the connection by using self-vulcanising rubber tape.

8. Close the microSpider as described later in this chapter.

Closing the microSpider Lite

NOTE: A video clip showing the case assembly for the microSpider2 Environmental, which uses a very similar case with the same type of O-ring as the microSpider lite, is available at www.halytech.com.au/images/downloads/microspider/o-ring.wmv

1. Insert the O-ring into the groove of the top half of the case. The easiest way is to hold one corner in and then run a finger around the groove a few times.
    The O-ring is pre-greased when shipped to ensure a good seal and easy assembly. If you need more lubrication use tap grease "Fix-a-tap", available at your local hardware store.

2. Align the two halves while making sure the antenna cable is not caught in-between. Using a hand at each end, pinch the flange at both ends with thumb and forefinger and squeeze gently until the halves slide together.

When correctly assembled, the two halves will remain together when finger pressure is removed. **If the O-ring is pushing them apart then something is wrong – you must repeat the assembly procedure.**

3. Insert the four screws and nuts but do not over-tighten. Force is not required to maintain the seal.

Inputs and Outputs Connectors

The microSpider lite has a single 8-pin I/O connector.

I/O CONNECTOR BACK (SOLDER) END VIEW

Pin numbers are as shown above, when looking at the back (solder end) of the connector with the notch facing upwards. Both connectors have identical pinouts**.**

I/O CONNECTOR

PIN	FUNCTION	COMMENT
1	SWITCH 1 / COUNTER 1 / QUADRATURE 1A	Active is short to GROUND
2	ANALOGUE 1	0 – 2.4V range
3	GROUND	
4	SWITCH 2 / COUNTER 2 / QUADRATURE 1B	Active is short to GROUND
5	ANALOGUE 2	0 – 2.4V range
6	GROUND	
7	OPEN COLLECTOR OUTPUT	Nominal 10 mA
8	INTERNAL LOW VOLTAGE SENSOR POWER SUPPLY	User selectable as 3.3V or 5V, supplied by internal battery, max 100 mA

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

Protecting Connectors

Prior to leaving a site, you must ensure that the communications connector is fitted with supplied sealing caps to prevent contact contamination.

Power Sources

microSpider Lite does not have an On/Off switch. The unit starts operating as soon as power is applied. The microSpider Lite incorporates a sophisticated power management system to maximise battery life. The internal battery will power the microSpider2 for several years under normal operation. This is a non-rechargeable battery.

Physical Connections (microSpider2 Industrial)

A new microSpider2 Industrial is shipped without a SIM card. You need to open up the microSpider2 Industrial to insert a SIM card and to connect the internal 9V memory backup battery.

Opening the microSpider2 Industrial

Note: Disconnect all external power supplies, sensors etc. before taking apart microSpider2 Industrial.

Release the two clips (at each end) by pressing on the plastic tabs to remove the top half of the case from the base.

Closing the microSpider2 Industrial

Align the top of the case with the base and then press down so the two plastic clips lock into the top half of the case.

SIM Card Installation

You need a SIM card to send SMS and to receive automatic reports from your microSpider2 via modem.

Halytech can provide fully functioning SIM cards for you.

If you want to source your own SIM card, contact your preferred mobile phone carrier and ensure that the SIM card is provisioned with a plan enabling internet data access.

To install a SIM card:

1. Put the SIM card in a standard mobile phone and disable any PINs

2. Open up the microSpider2 as described earlier in this chapter

3. Insert the SIM card into the holder.

   microSpider2 units are fitted with two different type of SIM card holders. They are easily distinguishable by the colour of their cover - either black of silver. Please follow the instructions relevant to the type of SIM card holder installed in your unit.

If your microSpider2 is fitted with a **BLACK** SIM card holder:

  a. Slide the SIM card cover holder to the "OPEN" position
  b. Lever it upwards on its hinge to open it.
  c. Slide the SIM card into the groove of the cover, observing the proper notch orientation.
  d. Close the cover and slide the cover into the "LOCK" position.

a.

b.

c.

d.

If your microSpider2 is fitted with a **SILVER** SIM card holder:

  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.

4. Close the microSpider2 as described earlier in this chapter.

Connecting Internal 9V "Backup" Battery (Optional)

The internal 9V battery serves as a 'backup' for microSpider2's RAM. RAM is used to maintain information such as counters, alarm state, when the modem should perform retries, and other current system information. Should microSpider2 lose power entirely, RAM will be lost, and on reboot the information listed above will reset.

In the event that microSpider2 Industrial loses power (External Power In drops below 10V), the backup battery will be used to maintain microSpider2 Industrial in a low-power mode which will maintain the RAM. When in low-power mode, the microSpider2 will not log, and will not be accessible via LAN (even if a USB cable is connected).

To exit the low power mode and resume normal operation, External Power of 12V must be applied to the microSpider2.

To insert the battery, open up the microSpider2 and connect a standard 9V battery to the battery clip. Insert the battery into the metal holder – as shown in the picture. Close the microSpider2.

LAN Power Selector

The network (LAN) interface of the microSpider2, (see Appendix F2 for details) can operate in two different modes.

Select your desired mode by opening up the microSpider2 and inserting the black jumper as required:
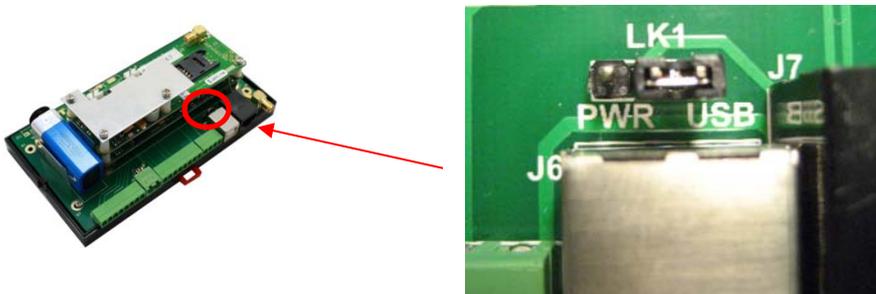
"USB" position – This is the default position. The microSpider2 will communicate with an external computer only if both the USB cable and the LAN cable are connected to the computer. This mode provides the lowest possible power consumption and should always be used for battery powered installations.

"PWR" position – Use this position only for mains powered units. The LAN interface will always be powered enabling continuous LAN communications with external PC's, at the cost of significantly increased power consumption. Only the LAN cable needs to be connected. This setting is suitable for industrial applications requiring continuous LAN access.

Connecting Antenna

Connect the antenna lead by screwing the flying lead connector onto the gold antenna "ANT" connector – finger tight only

Antenna Connector

Connecting Power

Connect a 16V – 24V DC, 2A minimum current Power Supply or a 12V Solar Panel to the "Charger" connector. Please observe the correct polarity.

Optional - connect a 12V SLA battery of **no more than 7.2Ah capacity** to the "BT" connector. The battery will be charged automatically. Please observe the correct polarity.

16 – 24V 2A DC Power Supply / 12V Solar Panel

Optional 12V battery

Input and Output Connectors

FRONT I/O CONNECTORs (from left to right in previous image)

PIN	NAME	FUNCTION	COMMENT
D1	DIN1	SWITCH 1 / COUNTER 1 / QUADRATURE 1A	Active is short to GROUND
A1	AIN1	ANALOGUE 1	0 – 2.4V or 4-20 mA range
-	GND	GROUND	
D2	DIN2	SWITCH 2 / COUNTER 2 / QUADRATURE 1B	Active is short to GROUND
A2	AIN2	ANALOGUE 2	0 – 2.4V or 4-20 mA range
-	GND	GROUND	
PO	PWR OUT	SWITCHED POWER OUT	Driven by CONTROL 1, max 1A
-	GND	GROUND	

PIN	NAME	FUNCTION	COMMENT
BT+	PWR IN	EXTERNAL POWER IN or BATTERY	Nominal 12V DC max 7.2Ah battery
BT-	GND	GROUND	

PIN	NAME	FUNCTION	COMMENT
D3	DIN3	SWITCH 3 / COUNTER 3 / QUADRATURE 2A	Active is short to GROUND
A3	AIN3	ANALOGUE 3	0 – 2.4V or 4-20 mA range
-	GND	GROUND	
D4	DIN4	SWITCH 4 / COUNTER 4 / QUADRATURE 2B	Active is short to GROUND
A4	AIN4	ANALOGUE 4	0 – 2.4V or 4-20 mA range
-	GND	GROUND	
PO	PWR OUT	SWITCHED POWER OUT	Driven by CONTROL 1, max 1A
-	GND	GROUND	

PIN	NAME	FUNCTION	COMMENT
OC	OC OUT	OPEN COLLECTOR OUTPUT	Driven by CONTROL 2, nominal 10 mA
-	GND	GROUND	
LV	LV OUT	INTERNAL LOW VOLTAGE SENSOR POWER SUPPLY	User selectable as 3.3V or 5V, max 100 mA
-	GND	GROUND	

BACK I/O CONNECTORs

PIN	NAME	FUNCTION	COMMENT
CHG+	CHARGER IN	CHARGING POWER IN	Nominal 16 - 24V 2A DC or 12V Solar Panel
CHG-	GND	GROUND	

NOTE: all of the GROUND pins are equivalent and all inputs and outputs are referenced to this common ground.

Connecting Sensors

The microSpider2 environmental and industrial have four digital channels (DIN1→DIN4) and four analogue channels (AIN1→AIN4). The microSpider Lite has 2 digital and 2 analogue channels.

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 microSpider2'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 microSpider2.

Switches

Switches are connected between a digital input pin and ground. When the switch closes for 3 seconds or more, the microSpider2 recognises a transition in the corresponding Switch channel. A diagram for connecting a typical switch to the microSpider2 is shown below.
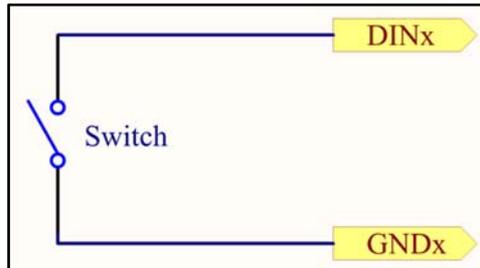
For example: a switch is to be connected to digital input 2 of the microSpider2. The switch should be wired between DIN2 and GND. When the switch closes, DIN2 will be shorted to ground and the microSpider2 will detect the switch closure after 3 seconds.

Counters and event-type

Counter and Event channels make use of the microSpider2's digital inputs. When the sensor pulses and shorts the digital pin to ground, the microSpider2 registers an event and acts accordingly. A diagram for connecting a pulse output to the microSpider2 is shown below.
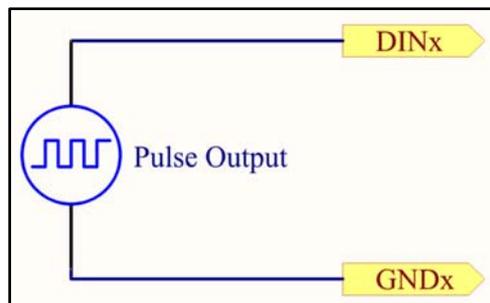
For example: a flow meter is to be connected to digital input 2 as a Utility Meter. The flow meter must be wired between DIN2 and GND and the channel set up as a Counter type with the "Log difference in reading" feature enabled. The microSpider2 will detect the flow meter's pulses and increment the channel's 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 microSpider2 will detect the rain gauge's tips, record an event, and update the running total.

Rotary / shaft encoders

Rotary encoders usually provide a "quadrature" output consisting of two phases. Each phase must be connected to a separate digital input.

Supported phase connections are:
        Phase 1 = DIN 1 and Phase 2 = DIN 2
or   Phase 1 = DIN 3 and Phase 2 = DIN 4

For example: The user wishes to connect a rotary encoder to quadrature input one. 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).

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:

Supported connections are:
        Forward = DIN 1 and Reverse = DIN 2
or   Forward = DIN 3 and Reverse = DIN 4

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 their minimum measurement value, and 20mA to represent their maximum measurement value.

Each of the microSpider2's four analogue inputs (AIN1→AIN4) can be used as a pre-calibrated 4-20mA channel. The sensor's output loop can be wired directly into any of the microSpider2'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 microSpider2'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.
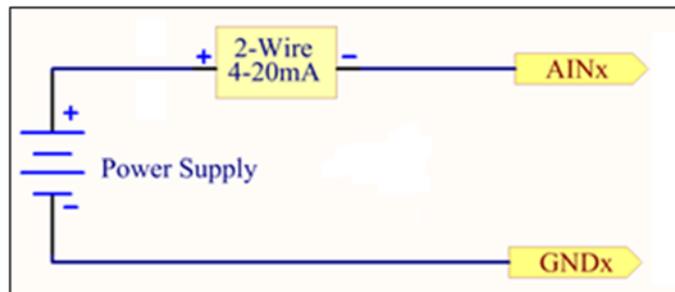
NOTE: no external resistor is needed when the 4-20mA input type is selected. These inputs contain an internal resistor and are pre-calibrated.

4-wire arrangement

4-wire 4-20mA sensors have a separate power loop and output loop. A diagram for connecting sensors of this type is shown below.
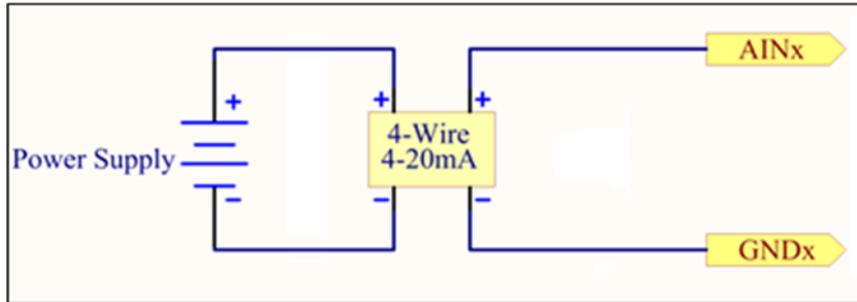
NOTE: no external resistor is needed when the 4-20mA input type is selected. These inputs contain an internal resistor and are pre-calibrated.

Voltage output sensors

Voltage output sensors communicate their data by outputting a voltage level which changes based on the sensor's measurements. Any of the microSpider2's analogue voltage inputs (AIN1→AIN4) can be used for connecting sensors of this type.
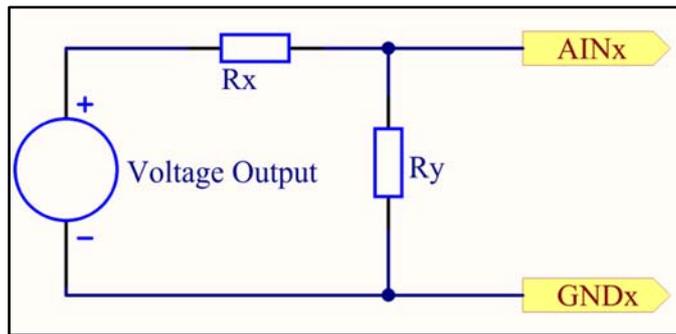
The microSpider2's analogue voltage inputs (AIN1→AIN4) can produce readings directly for voltages between 0V and 2.4V

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 microSpider2'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

Setting up a microSpider2 for the first time

A new microSpider2 is shipped from the factory with a default, generic setup. You will need to change this setup and customise the microSpider2 for your application.

Setting up a microSpider2 involves one or more of the following steps:

1. Setting location
2. Setting date and time
3. Setting your username and password
4. Configuring Inputs
5. Calibrating Analogue Inputs (if present)
6. Scaling Counter and Event Inputs (if present)
7. Setting Control names
8. Setting up Alarms
9. Setting up Network parameters
10. Setting up E-mail / FTP parameters
11. Setting up NTP parameters (optional)

Connect to the microSpider2 as described in Appendix E1 or E2.

The login screen is the first screen you will see once you have successfully connected to the microSpider2 using your computer. At the bottom of the login page, the microSpider2 displays the current date, time, software version, and serial number. These are useful for quickly identifying the microSpider2 without logging in.
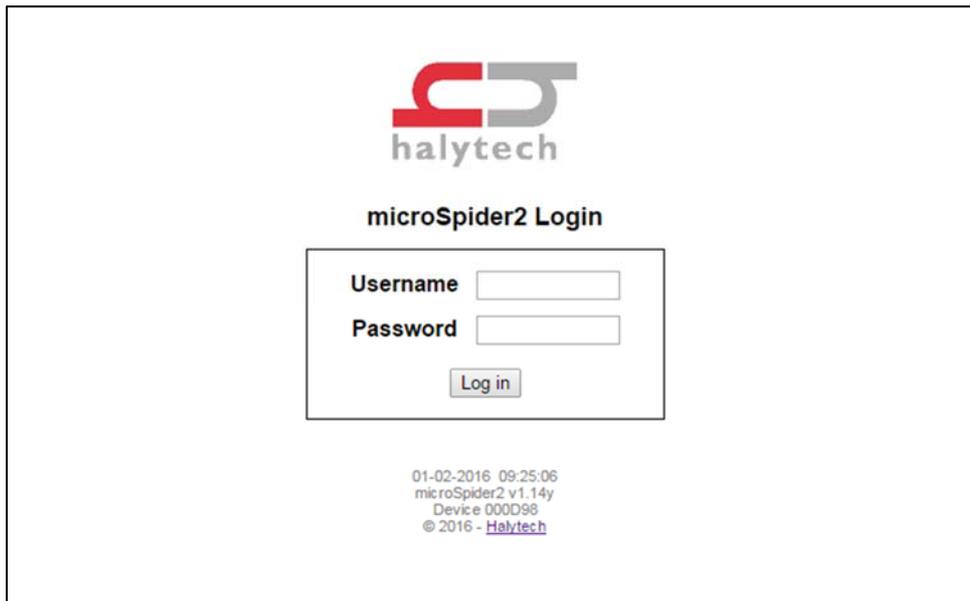
Default username: user
Default password: changeme

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 microSpider2's web interface. If log in fails, you will be redirected back to the Login 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.

After logging in, the Current Alarms page will be displayed.

View Setup

The View Setup page allows you to review all of the microSpider2'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 page shows some common information including the microSpider2'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

- Control 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

Change Setup

To actually make changes, click on "Change Setup" on the blue menu pane.

A confirmation message will appear. Click "OK" to proceed.

The following page will be displayed:

NOTE: As indicated by the confirmation message, accessing the *Change Setup* page automatically disables logging, alarm generation, and acknowledges all active alarms. You can ignore the message here as we are setting up the device for the first time.

Accessing On-Page Help

Many of the microSpider2's webpages contain on-page help. This may be accessed by clicking the 'Help!' link at the top right of the page. Help will open in a new window and will cover topics on the page itself. On-Page help is useful if you are in the field and need a quick refresher. Much of the content contained within this manual is reproduced in on-page help.
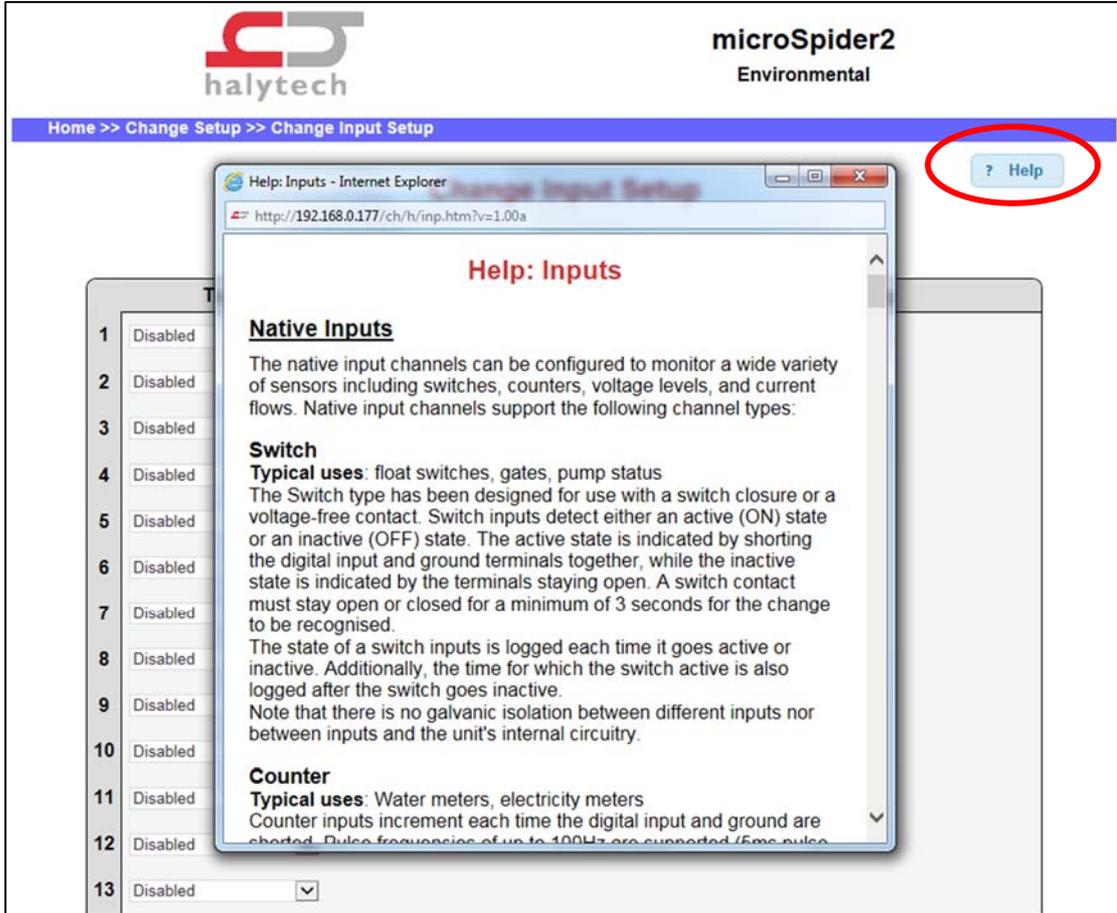
Setting Location

It is important to choose a unique location name for each microSpider2 so that you can easily identify it down the track. The location name is also used by the microSpider2 when sending reports and alarm alerts.

There is also a *long location name,* which is used if additional information is required to describe the location of the microSpider2.

If not already displayed, access the *Change Setup* page as described in "Setting up a microSpider2 for the first time" above.

Click the "Location" link.   This will bring you to the Change Location page, shown below:

From here, you can enter a location name for this particular microSpider2. The name can be up to 17 characters long. In the screenshot above, the location name was set to "microSpider Demo".

Click the *Save* button to save your changes to the microSpider2's configuration, or click *Cancel* to return to the *Change Setup* page without saving any of the changes.

Setting Time and Date

Setting the microSpider2'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 microSpider2's time and date by clicking on 'Set from computer' and then clicking 'Save'.

The microSpider2 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 microSpider2's time will be synchronised daily. This ensures that the microSpider2'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 microSpider2'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 microSpider2 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 and time zone.

Setting User and Password

Only authorised users may access a microSpider2. A correct username and password must be entered in the *Log In* page before any of the microSpider2's settings can be viewed or changed.

The microSpider2 supports three levels of access:
- The **Administrator** account has full control of the microSpider2, 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 microSpider2'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 microSpider2.

To change the username and password of any 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.

Note: in the event of a forgotten username and password, you will not be able to gain access to the microSpider2's web interface. If this happens, please contact Halytech or one of its agents for assistance.

Configuring Inputs

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.

Take a note of the various columns on the table:

- **Type**: Shows the base type of the channel (see Native Inputs, below)

- **Source:** Location of 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 Setting up Alarms for more information).

- **Name**: The name of this channel. This is used in Filtered and Multi-Column reports as well as 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 B" 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 (Cog)**: This column contains a button which allows you to change additional channel options (see Additional Input Options, below).

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 channel's 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 – see chapter on "Setting up Alarms" for details

- **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.

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 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 shorted[1]. The microSpider2 supports pulse frequencies of up to 100Hz on its counter inputs.

- **Event** – typical uses include tipping bucket rain gauges

  Event inputs are used to record occurrences of pulses[1]. 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 10ms. Each time an event occurs, the microSpider2 logs the time of its occurrence as well as the total number of events.

  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.

- **Analogue (4-20mA)** – typical uses include pressure, flow rate and pH sensors.
  The microSpider2 has four analogue input channels, each of which can be configured as a 4-20mA input, by selecting the "Analogue (4-20mA)" type.
  These channels are pre-calibrated and have all required biasing resistors built in. This channel is logged at the defined intervals.

- **Analogue (Voltage) –** typical uses include pressure, temperature weight etc.
  Each analogue input can also be configured for use with voltage sensors, by selecting the "Analogue (Voltage)" type. They support a 0 – 2.4V voltage range directly however other ranges are easily accommodated via external resistors, as shown in Connecting Sensors. This channel type 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 Setting up Alarms for more information.

- **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 above in the **Voltage output sensors** section.

Note that there is no galvanic isolation between different inputs nor between inputs and the microSpider2 internal circuitry.

System Inputs

Each microSpider2 provides a number of system channels which can be used to monitor the microSpider2's hardware, as described earlier under "System Monitors".

To monitor the system temperature, select "System (Temperature)" as the channel type and "Temperature" as the source.

A range of system voltages can also be monitored, depending on whether you have microSpider2 Environmental or Industrial.

To monitor a system voltage, select "System (Voltage)" as the channel type and then select the source as follows:

- **External Power:** voltage on the *PWR IN* port

- **LAN Power:** voltage supplied to the LAN port

- **Battery 1:** voltage of the battery connected to *BATT 1* (Environmental only)

- **Battery 2:** voltage of the battery connected to *BATT 2* (Environmental only)

- **System Moisture Detector:** 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 microSpider2 damage due to exposure to moisture for prolonged periods of time (Environmental only)

- **Charger:** voltage of the power supply or solar panel connected to the *CHG* port (Industrial only)

System input channels can be used for logging and triggering alarms in the same way as other channels.

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.

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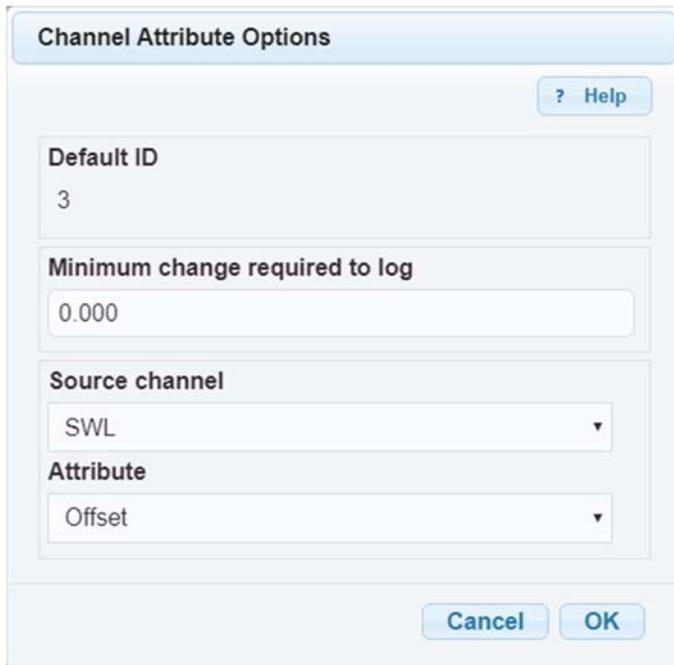
The **Source channel** specifies which input channel to get the attribute from.

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.

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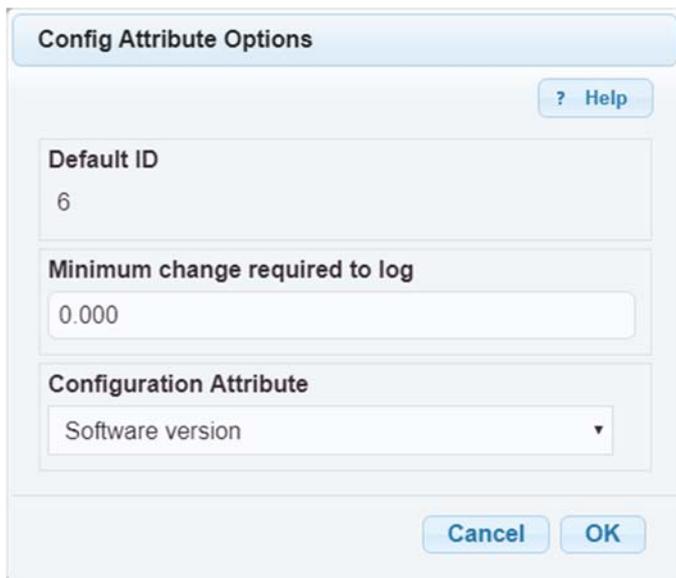
The following attributes, selectable from the Configuration Attribute drop-down list, are currently available:

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

Super Channels

Super channels derive their value from computations on one or more physical (native, intelligent or system) inputs.

The following super channels are currently available:

- **Rating Table:** Takes an input channel and applies linear or logarithmic interpolation based on a lookup table.

- **Ax + By + C:** Takes two input channels and adds or subtracts them, optionally scaling the inputs and/or adding a fixed offset.
  This is often used to calculate the sum or difference of two inputs.

- **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.

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 super channel's 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:
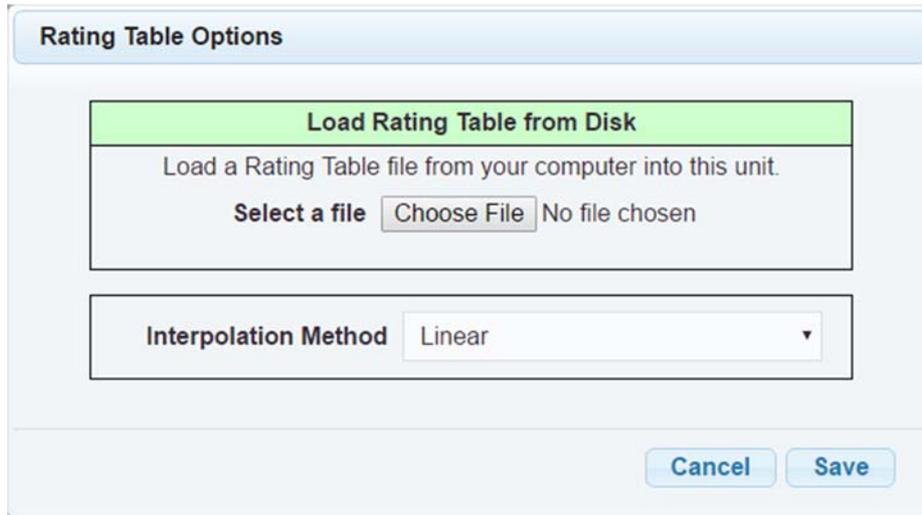
These options allow the user to upload a rating table compatible with that generated from the Hydstra software (see **Appendix L: Rating Table File Format** for details), and to select the Interpolation Method to be used. The options are **Linear** and **Logarithmic**.

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:
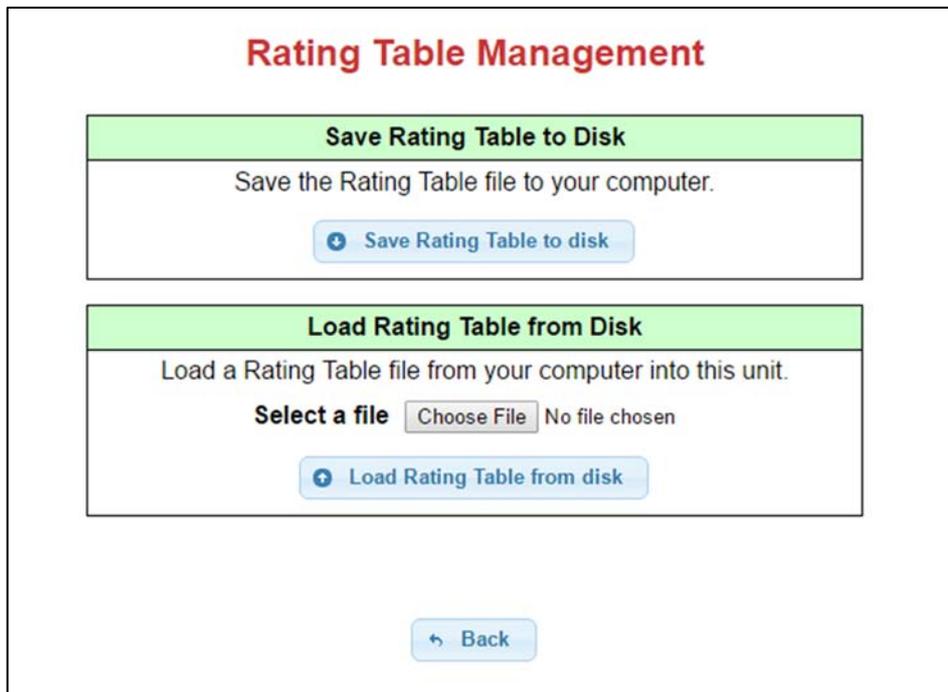
Ax + By + C

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 or zero), 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'):

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.

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 ºC
R_s = Daily solar radiation in kJ/m^2/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'):

Evapotranspiration Options

     ? Help

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

Default ID

1

Log difference in reading over logging period

☐

Minimum change required to log

0.000

Evapotranspiration

Total Solar Radiation (kJ/m^2/day)   Solar radiati ▾

Mean Temperature   Temperature ▾

     Cancel   OK
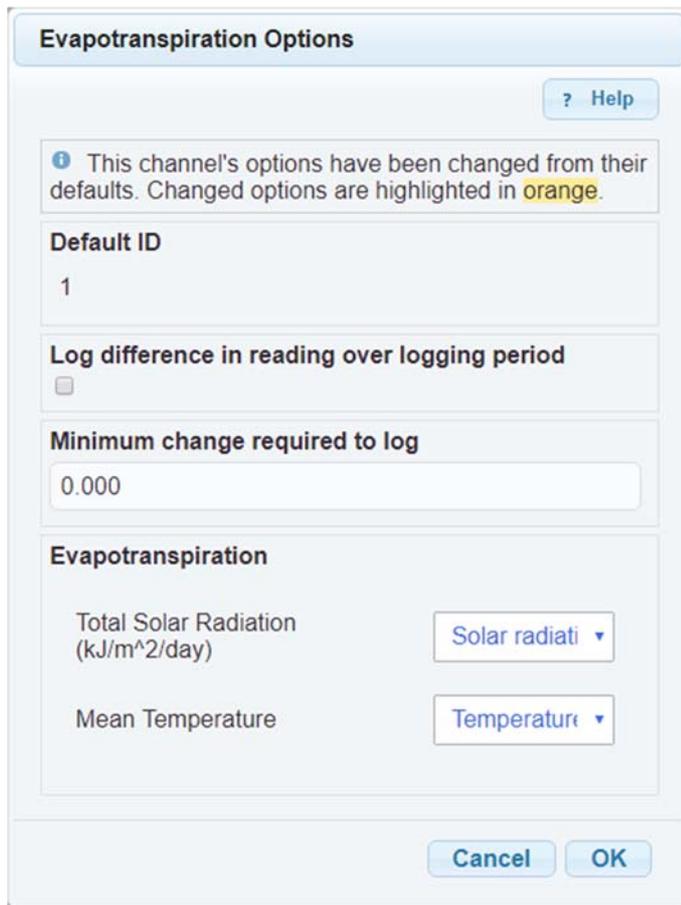
Total Solar Radiation is the total sunlight accumulated in a day, measured in kJ/m^2/day.

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/m^2 instead of kW/m^2, you must also select the **Divide Samples by 1000** option, to convert W to kW. The integrated value will then be in kJ/m^2/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 ºC, 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.

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:
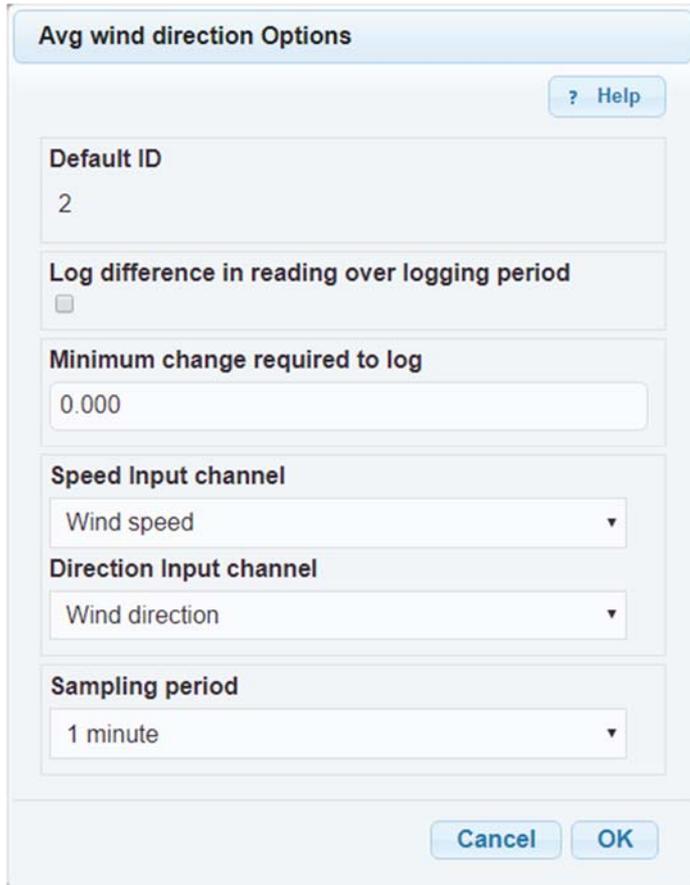
```
Avg wind direction Options

                                                    ?  Help

Default ID
2

Log difference in reading over logging period
☐

Minimum change required to log
0.000

Speed Input channel
Wind speed                                          ▼
Direction Input channel
Wind direction                                      ▼

Sampling period
1 minute                                            ▼


                                      Cancel      OK
```

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.

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.

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, <u>both</u> 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 pulse[2].

- All other channel types, including analogue inputs, counter inputs, system monitors and intelligent inputs, 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.

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:

Default ID

---

[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.

This is the channel ID number shown in the raw and diagnostic report types. These are fixed for each channel and cannot be adjusted. See "Appendix B" for more information.

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

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-required-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.

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.

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:

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 microSpider2 will simply log every sampled value.

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 microSpider2.

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.

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 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 microSpider2 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
12:31:00	114.15
12:32:00	115.15
12:33:00	112.15

Then at the end of 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 B for more details on report identifiers.

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.

Warmup source

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

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. Each control has a warm-up time associated with it (see chapter on "Configuring Controls"), 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 then the Switched Power Out control is turned back off. This warm-up process repeats for every sample performed.

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.

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.

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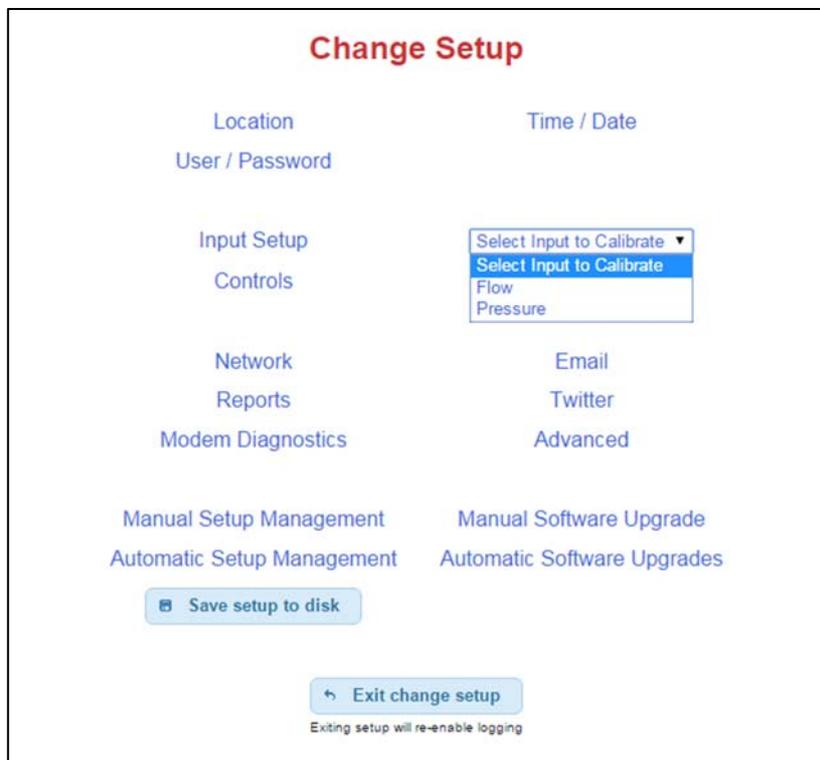
This takes you to a "Channel Calibration" page, where you can select the calibration method to be used.

There are a number of different calibration methods available in the microSpider2. Only those appropriate for the input being calibrated will be listed on the "Channel Calibration" page

They are covered in the following sections.

4-20mA Calibration

Applies to: Analogue (4-20mA)

The microSpider2's 4-20mA channels are factory calibrated, therefore on the 4-20mA calibration screen you only need to enter the real-world values that correspond to the sensor's 4mA and 20mA readings.
The microSpider2 will then automatically work out the correct scaler and offset values.

Channel Calibration

Water Level

Sensor low (4mA) reading	0.000	m
Sensor high (20mA) reading	10.000	m

× Cancel   ✓ Save

For example: A 4-20mA pressure sensor is measuring water level. The 4mA reading corresponds to 0 metres, and a 20mA reading 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.

Manual Calibration (counter)

Applies to: Counter, Event, Difference, Quadrature

Channel Calibration

Rainfall

1 mm = 5   pulses (0.200 mm per pulse)

Desired Value: 3.200

Calibrated Value: 3.200 mm φ Update

× Cancel   ✓ Save

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 microSpider2's reading match the current reading on the sensor (if given). Simply enter the sensor's reading as the desired value and the microSpider2 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

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:	0.0200000
Offset:	0.000
Calibrated value:	23.180 bar ↻ Update

× Cancel   ✓ Save

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.

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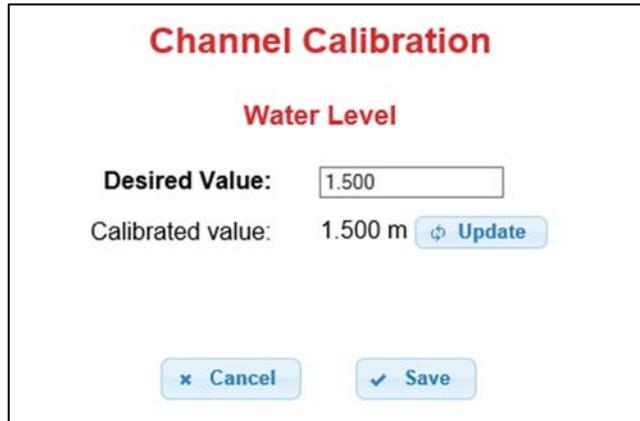
This page also shows the current calibrated value, which can be updated at any time by clicking the *Update* button.

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.

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 microSpider2'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.
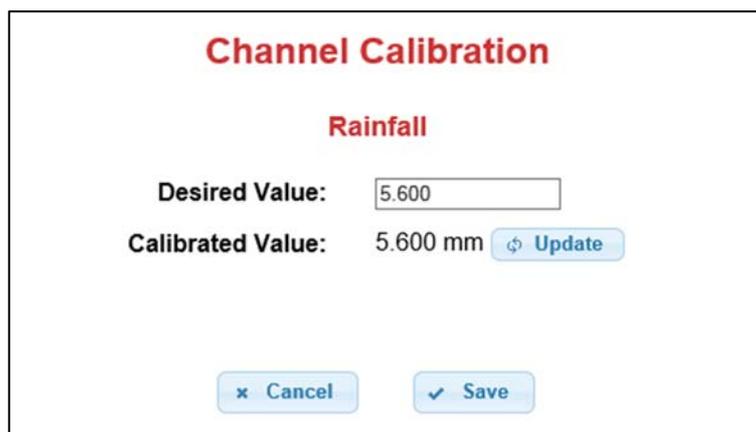
Simply enter the sensor's reading as the desired value and the microSpider2 will start counting from there.

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

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 2-point calibration page will lead you through a series of steps, after which the microSpider2 will calculate the correct offset and scaler 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 (by clicking the *Update* button) to show 178.

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, by clicking the *Update* button, to show 3783.

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: [20]

3. LOCKED to: 178

4. Set transducer to maximum value

5. Enter desired reading: [290]

6. LOCKED to: 3783

[✕ Cancel]   [✓ Save]

The 2-point calibration procedure is now complete. Click the save button to save these values to the microSpider2.

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.

Configuring Controls

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

Each control has the following two settings:

- **Custom name**: a name given to this control so it can be easily identified on other pages (eg: "Pump Control" or "Sensor Power").

- **Warmup time**: only used if this control is set up as a sensor warmup source. This specifies the amount of time this control should stay active for before a sensor reading is taken – see chapter on "Configuring Inputs" for details.

The voltage supplied by the Low Voltage Out control is selectable between 3.3V and 5.0V.

The SDI-12 Command control sends a custom text string over SDI-12 whenever it is activated and/or deactivated. The "On command" string is sent over SDI-12 when then control activates, and the "Off command" is sent when the control deactivates.

Setting up Reports

A report is a file that contains the data a microSpider2 has logged. The microSpider2 is capable of generating reports in a number of different formats, and reports can be retrieved from or sent by the microSpider2 in a few different ways:

- **Manually using the web interface**: The user can download part or all of the microSpider2's logged data. See chapter on "History".

- **Automatically**: A microSpider2 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 microSpider2 can be configured to automatically send reports over email, FTP and/or HTTP whenever an alarm occurs. See "Setting up Alarms", below.

- **Manually by requesting it with an SMS message**: a report can be triggered by sending the microSpider2 an SMS report request. This report can be sent over email. See chapter on "SMS Commands".

The microSpider2 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 Report Settings page. This page can be accessed by going into Change Setup and clicking the *Reports* link. A screenshot of this page[3] is shown below:

---

[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 and alarm reports.

On the right are the available report destinations:

- **Email List**

  o **Email 1 - 3**: The microSpider2 allows up to 3 email addresses to be specified. The report is emailed to each of the addresses in this list.

- **FTP Server 1 and FTP Server 2**

  o **Server**: Hostname or IP address of the FTP server which will have the report files uploaded to it.

  o **Username**: Username to access the FTP server

  o **Password**: Password to access the FTP server

  o **Directory**: The directory on the FTP server in which the microSpider2 should upload the report files.

  o **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 microSpider2 has write access to the nominated FTP directory.

- **HTTP Server**

  o **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.example.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.

  o **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.

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. Eg: 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. Eg: 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 report fails to send (e.g.: signal issues, network congestion, etc.), report recovery will cause any unsent data to be sent in the next 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.

    Raw and Diagnostic formats contain all the logged data plus system information such as reception of SMS messages, outcome of alarms, reports etc.[4] The User ID report format makes use of the User-defined ID (rather than the Default ID) assigned to each input. The raw, diagnostic and user ID file formats are detailed in Appendix B.

    Filtered format provides data in a simpler form. It contains only logged input data. The filtered file format is described in Appendix C.

    Multi Column format provides data of multiple channels in a single row. It contains only logged input data. The multi column file format is described in Appendix D.

    Aligned multi-column format has the same layout as standard multi-column format, except that all of the records are reported on the closest general logging period timestamp – see Appendix D for details.

    Custom formats, intended for specific purposes, are described in Appendix E.

---

[4] The 'Diagnostic Only' format excludes the logged data and contains only system messages and diagnostic codes.

- **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 HTTP 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 Setting up Alarms, below.

One final option is **Reset Report Starting Point**. When this button is clicked, the microSpider2 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 microSpider2 from appearing in the first daily and periodic reports.

Setting up Alarms

A microSpider2 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.

- **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 microSpider2 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:
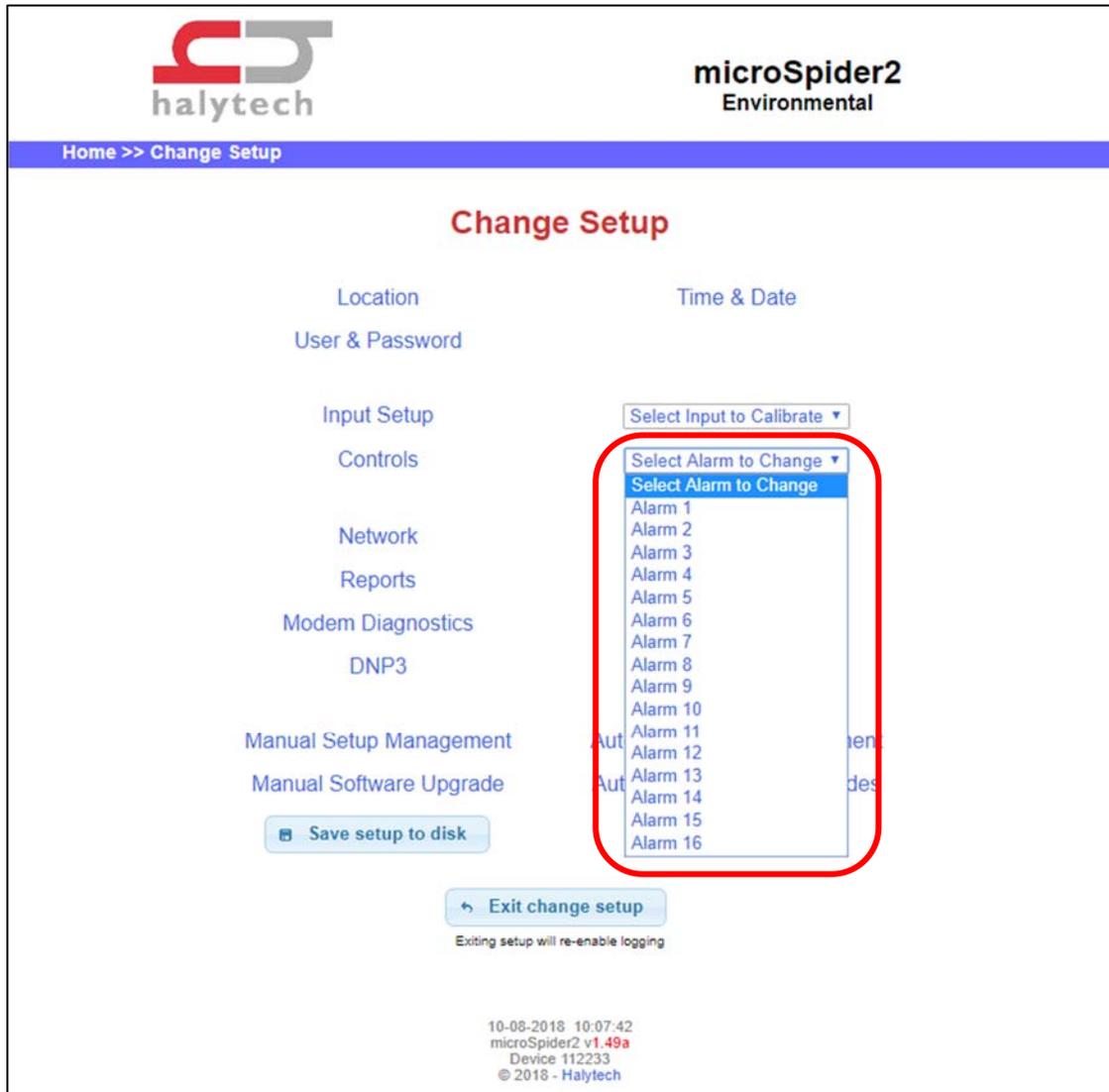
Once an alarm has been selected from the dropdown, you will be redirected to the *Change Alarm* page. A snippet of the *Change Alarm* page is shown below.

Alarm options

Each alarm has a variety of options for configuring its behaviour, as described below:

- **Alarm name**: the 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 Trigger Sources, below.

- **Qualifying time**: see Trigger Sources, below.

- **Send alarm report**: see Alarm Report Options, below.

- **Fast logging**: with this option 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:

   o   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) – see Trigger Sources, below

   o   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.

   Stop fast logging when: determines when the alarm should stop influencing the microSpider2's logging rate. It can happen either when the alarm condition goes inactive, or when the alarm is acknowledged – see "Alarm Acknowledgement" below.

- **Message**: this text will be present in alerts sent by this alarm.

- **Auto acknowledge time**: the amount of time after being triggered when the alarm should be automatically acknowledged (see below).

Alarm Actions

Each alarm can initiate a number of actions:

- **Control action**: see "Alarm control activation and deactivation", below.

   Alarms can optionally affect the selected control:

   o   **Continuously**: simply turns the control **On** or **Off**. The control will remain in that state until it's changed manually, or by another alarm.

   o   **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:

   o   **Increment**: increment a virtual counter by one (only available for channels with Source = **Virtual**).

   o   **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:

   o   **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.

- o **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 a control activates. See "Alarm control activation and deactivation", below.

- o **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.

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 on 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.

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 follow-up report is then sent some minutes (specified by **Followup report delay**) after the alarm is triggered. This second report contains the 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.

    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).

    Follow-up 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 contains the 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 follow-up 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:

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 Appendices B, C and D for details of the various 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.

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.

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

Analogue channel as a trigger source

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

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:

  o **Above**: Active when the channel value is above the specified value

  o **Below**: Active when the channel value is below the specified value

  o **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

  o **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.

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.

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 every Monday at 00:00.

Periodic

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

Trigger source	Periodic
Period	15 minutes ▾
Offset	0 hours 0 minutes 0 seconds
Remain active for	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.

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.

For example: take the scenario where the microSpider2 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 microSpider2 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

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 <u>not</u> 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 microSpider2 with a browser, go to the *Alarms* page, and click on the alarm they wish to acknowledge.

- **Auto Acknowledgement**: the microSpider2 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.

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 <u>both</u> 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 and 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 (e.g. the case of a float switch tripping continuously due to tiny changes in water level around its desired level).

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 microSpider2 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 (e.g. 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 (e.g. Switched Power Out 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 to start 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 300 seconds (5 minutes), but will not turn on again for 60 minutes, when the alarm is automatically acknowledged.

Setting up Network Parameters

The microSpider2 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	192.168.0.177
Network mask	255.255.255.0
Gateway	192.168.0.1
Easy Connect	☑

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

Primary Network

Method	Mobile Internet (Modem) ▼
APN	telstra.internet
Authentication	☐
Data limit	1.000 MB/day
Report signal strength	☑
Signal strength name	Modem Signal
Signal strength format	Percentage (%) ▼
SMS Recovery period	Weekly ▼
Modem phone number	

Secondary Network

Method	None ▼

✕ Cancel   ✓ Save

Local Area Network

For most users, these settings need not be changed as the microSpider2 can connect directly to a PC using a LAN cable or LANlink cable (see Appendix F for details).

This section has the following fields:

- **IP address**: This is the IP address that you will use to communicate with the microSpider2. 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 microSpider2 is going to be connected to a network. Please consult your network administrator for assistance.

- **Gateway**: May need to be changed if the microSpider2 is going to be connected to a network. Please consult your network administrator for assistance.

- **Easy Connect**: If your microSpider2 is connected straight to your computer/laptop (i.e. not to a network – see Appendix F), 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 microSpider2 is to be connected to a network.

Note: for microSpider2 Environmental, changes to LAN settings will take effect after the LANLink cable is disconnected and reconnected. For microSpider2 Industrial, the new settings take effect when LAN power is disconnected (by unplugging the USB cable or removing the LAN power jumper) then reconnected.

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.

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.

  o **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.

  o **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 the section on 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.

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.

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) external 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.

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".

SMS Recovery

If an SMS is sent to the microSpider2 when its modem is off, the message will be held at the Network (Telstra, Optus, Vodafone, etc.) and delivered once the microSpider2'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 microSpider2 once its modem does turn on. This means that if, for example, the microSpider2 turns the modem on to send out a report, then the microSpider2 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 microSpider2 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 microSpider2. SMS recovery happens after a report is sent out, so reporting must be enabled for this option to have any effect.

For example: A microSpider2 has its SMS recovery option set to *Daily*. A daily Report e-mail is being sent at 00:00:00 (midnight). The microSpider2 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 the microSpider2 from receiving SMS messages, but rather means that the microSpider2 will not provide this extra window for SMS messages to be received. It is still possible that the SMS is received whenever the modem is turned 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 LiveSMS option is enabled.

Setting up E-mail Parameters

Before the microSpider2 can send email alerts and email reports, it must be configured with email settings.

To do so, click the *Email* link from the *Change Setup* page. You will be presented with the *Change Email Settings* page, shown below:

- **"From" email address**: this is the email address the microSpider2 will use to identify itself. All emails received from the microSpider2 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 microSpider2 but cannot be delivered, your mail server will usually send a failure notice to this address. It is therefore recommended that you monitor this email address to detect failure notices.

- **SMTP mail server**: this is the mail server which will be used to send all of the microSpider2'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 microSpider2 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.

- **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 microSpider2 has access to mobile internet.

Setting up Twitter Parameters

The microSpider2 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 microSpider2 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 microSpider2 to securely Tweet on your behalf.

Both the oAuth token and oAuth token secret should be copied exactly into the corresponding fields on the microSpider2'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 I, l, and 1).

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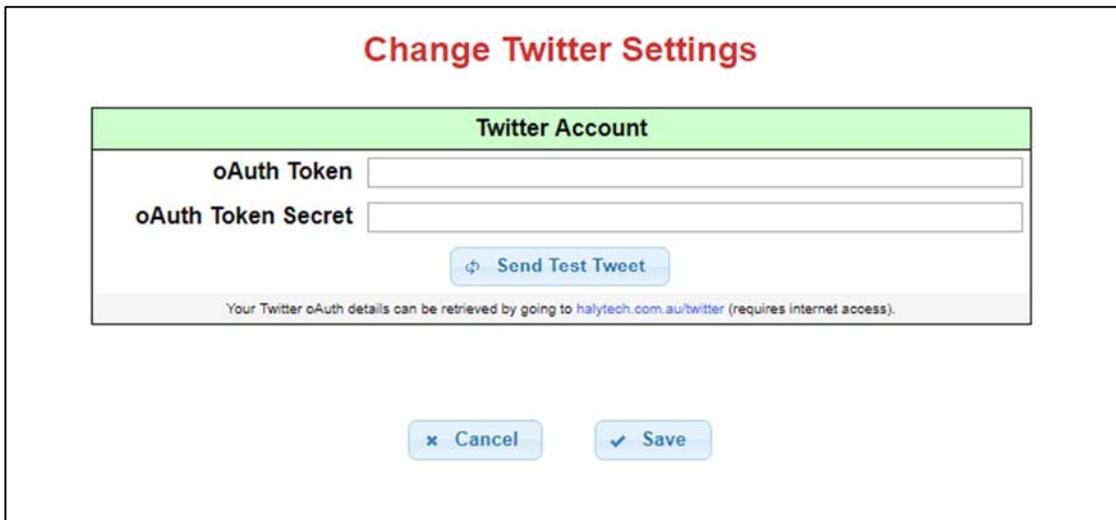
Change Twitter Settings

Twitter Account	
oAuth Token	
oAuth Token Secret	

φ Send Test Tweet

Your Twitter oAuth details can be retrieved by going to halytech.com.au/twitter (requires internet access).

✕ Cancel   ✓ Save

The **Send Test Tweet** button sends a test tweet, so that you can verify that the Twitter settings are correct.

Performing Modem Diagnostics

The Modem Diagnostics page is used to test the microSpider2'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.

ϕ Mobile Signal Test

SMS Test

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

Phone number [   ]

ϕ 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 microSpider2/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 microSpider2's location name, serial number, signal strength, and date/time.

These tests verify that the modem and SIM are working and can successfully access the mobile network.

Next, you should send a test email (see Setting up E-mail Parameters) or FTP (see Setting Up Reports) to verify that the SIM is able to send data, as not all SIM plans include data.

Automatic Setup Updates

The microSpider2 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:

Automatic Setup Management

Automatic Setup Updates ☑
FTP Server
Username
Password
Setup directory
Response directory

Setup file "msc000D98.cfg" will be requested from the setup directory

✕ Cancel   ✓ Save   ⊘ Save and Update

The microSpider2 will request a uniquely-named setup file from the FTP server. The name of the file is in the form:

msc*<serial number>*.cfg

For example, if your microSpider2's serial number is 000D98, the microSpider2 will request the file named msc000D98.cfg from the FTP server.

Note that if multiple microSpiders 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 microSpider2 will check for new setup files once per day after a report is sent out.
- **FTP Server**: The address of the FTP server which will be connected to when checking for setup updates.
- **Username**: FTP server username.
- **Password**: FTP server password.
- **Setup directory**: The location within the server where the setup file will be stored for the microSpider2 to download.
- **Response directory**: if the microSpider2 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 microSpider2 was successful in installing the setup file, and will detail any errors it encountered if unsuccessful. If the Response directory is left blank, the microSpider2 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 K for information about the format of the setup files.

Manual Setup Management

The *Manual Setup Management* page gives you some useful options for working with your microSpider2's setup/configuration:

- **Save Setup to Disk**: The microSpider2's entire setup can be downloaded to your computer. This file can later be loaded into other microSpiders or kept for reference.

- **Load Setup from Disk**: This allows you to load a saved configuration file from your computer into the microSpider2. This will overwrite the microSpider2's current settings with those in the loaded setup file.

    Note: the setup file has to be from the same product type (eg: microSpider2 Industrial config can only be loaded into other microSpider2 Industrial units) and 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 first for this to work.

- **Restore to Factory Defaults**: This option will reset ALL of the microSpider2'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:

Advanced

The *Change Advanced Settings* page provides various settings which change the default behaviour of the microSpider2. To access it, 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 60 minutes (default = 60 minutes)

Modbus-485 Settings
Baud Rate 19200 ▾
Parity Even ▾
Stop Bits 1 ▾

Advanced Logging Settings
Store messages with channel data ☑

- **Advanced Control Settings**: The *Turn all controls off* setting determines whether controls are turned off or not when the Change Setup page 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.

- **Advanced Alarm Settings:** The minimum that an alarm's Auto Acknowledgement time can be set to is normally 60 minutes. The *Minimum auto ack time* setting allows you to set up alarms with auto acknowledgement times as low as 5 minutes.

  Lowering this setting is useful if you want the microSpider2 to send out more alerts on alarms triggering off fast-changing inputs.

  See the chapter on "Setting up Alarms" for more information on alarms and auto acknowledgement.

- **Modbus-485 Settings**: These options allow you to specify communications settings, in case the default values are not suitable for your sensor (see your sensor's manual)

  - **Baud Rate**: Most Modbus-485 sensors use the default baud rate of 19200. However, some sensors use a baud rate of 9600 or some other value. You can select baud rates between 1200 and 57600 from the dropdown list.

  - **Parity**: Most Modbus-485 sensors use Parity = Even, which is the default setting. However, if your sensor requires Parity = None or Odd, you can select the appropriate parity setting from the dropdown list.

  - **Stop Bits**: Most Modbus-485 sensors use 1 stop bit, but your sensor may require 2 stop bits, especially if Parity = None. If so, you can select the number of stop bits from the dropdown list.

- **Advanced Logging Settings**: 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, or controls being operated, 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.

If you are using a microSpider2 with the LiveSMS option enabled, you will also see a LiveSMS Settings section on this page – see the chapter on "Live SMS" for details.

Exiting Change Setup Mode

Logging and alarm activation are disabled while in the change setup mode.

To exit change setup mode, click the *Exit change setup* link on the bottom of the "Change Setup" page.

This will immediately restart logging and alarm generation.

Setup change mode is automatically exited after 20 minutes of inactivity.

Normal Operation

Communicating with a PC

microSpider2 uses an intuitive, user-friendly, web-browser system. You can use any standard browser on any computer to communicate with the microSpider2. No special software is required. Communicating with a microSpider2 is identical to "Surfing the Internet". Information is displayed by clicking links and buttons.

You can connect to a microSpider2 locally via a network cable (see Appendix F for details), or, if you have the LiveSMS software option, you can connect remotely (see Appendix H).

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.

All alarms are identified by their user-configured names.
The display shows the state of all alarms at the time the page was displayed. The page automatically updates every 10 seconds.

By default, there aren't any alarms configured in the microSpider2. 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.

Active alarms provide additional information about the progress of the alarm sequence by displaying a numerical code. Please refer to Appendix I for the key to the code.

Alarms are shown in red until they are acknowledged.

Alarms can be acknowledged individually by clicking the particular alarm.

ALL unacknowledged alarms may be acknowledged at once by clicking on the "click here" link at the bottom of the main pane.
If there are no unacknowledged alarms, the command will be ignored.

Alarms with "Auto Acknowledge" enabled will be acknowledged automatically after the set period of time. You may still manually acknowledge such an alarm, if desired.

Inputs

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.

Controls

Current Controls and their associated overrides (if applicable) are displayed by clicking "Controls" on the blue menu pane on the left. The controls are identified by their user-programmed names.

The display shows the state of the 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.

History

microSpider2 logs:

1. Input changes
2. System monitor changes
3. Control changes
4. Alarm activations and resets
5. SMS transmissions and their outcomes
6. SMS command reception
7. E-mail transmissions and their outcomes
8. FTP and HTTP transmissions and their outcomes
9. System messages

Each log record consists of a date and time stamp to a resolution of 1 second, two numeric record identifiers and a short text describing the record. You can selectively download logged data.

Logged data is downloaded by first clicking "History" on the blue menu pane on the left.
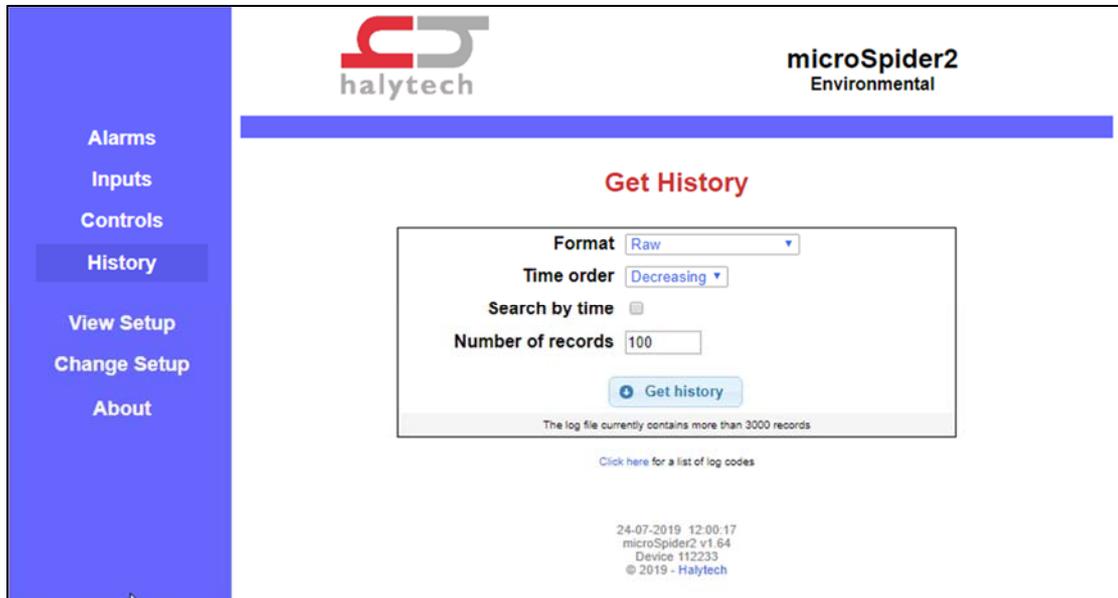
The Get History options are:

- **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. The raw, diagnostic and user ID file formats are detailed in Appendix B.

  Filtered format provides data in a simpler form. It contains only logged input data. The filtered file format is described in Appendix C.

  Multi Column format provides data of multiple channels in a single row. It contains only logged input data. The multi column file format is described in Appendix D.

- **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.

About

"About" screen displays system information such as hardware and software version and installed options as well as the contact details for Halytech.

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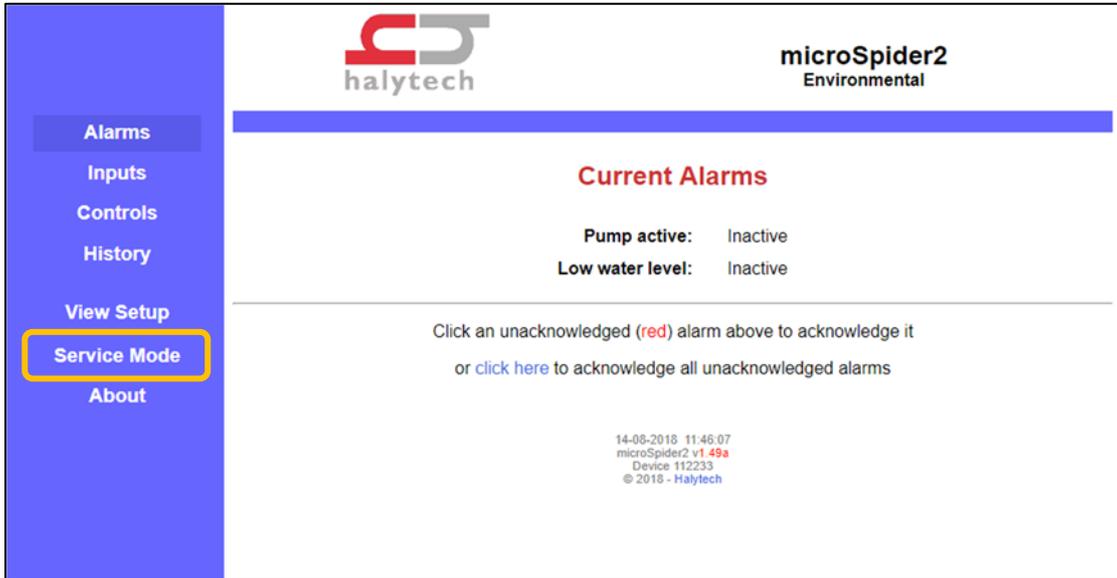
The service mode is intended to allow field personnel perform diagnostic tests, recalibrate and test sensors, reset the unit's time and perform software upgrades, without being granted access to change the unit's setup.

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.

Time and Date

The service account is able to set the microSpider2's time and date, as described in *Setting Time and Date*, but without the ability to change the NTP settings:
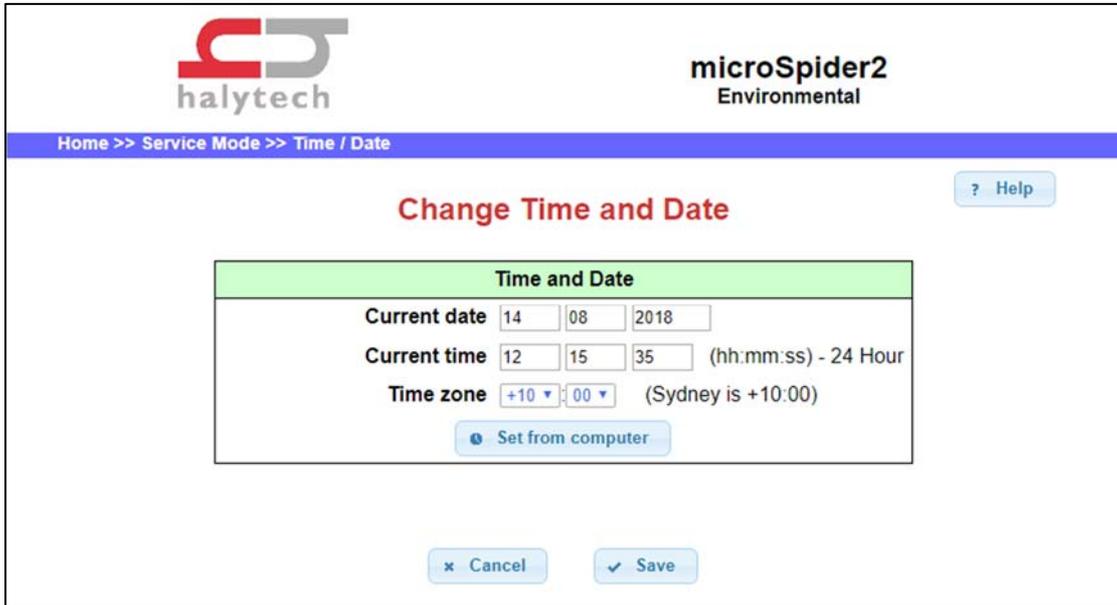
Modem Diagnostics

The Modem Diagnostics page is used to test the microSpider2's modem. It includes tests for modem signal strength and sending SMS messages, as described in *Performing Modem Diagnostics:*
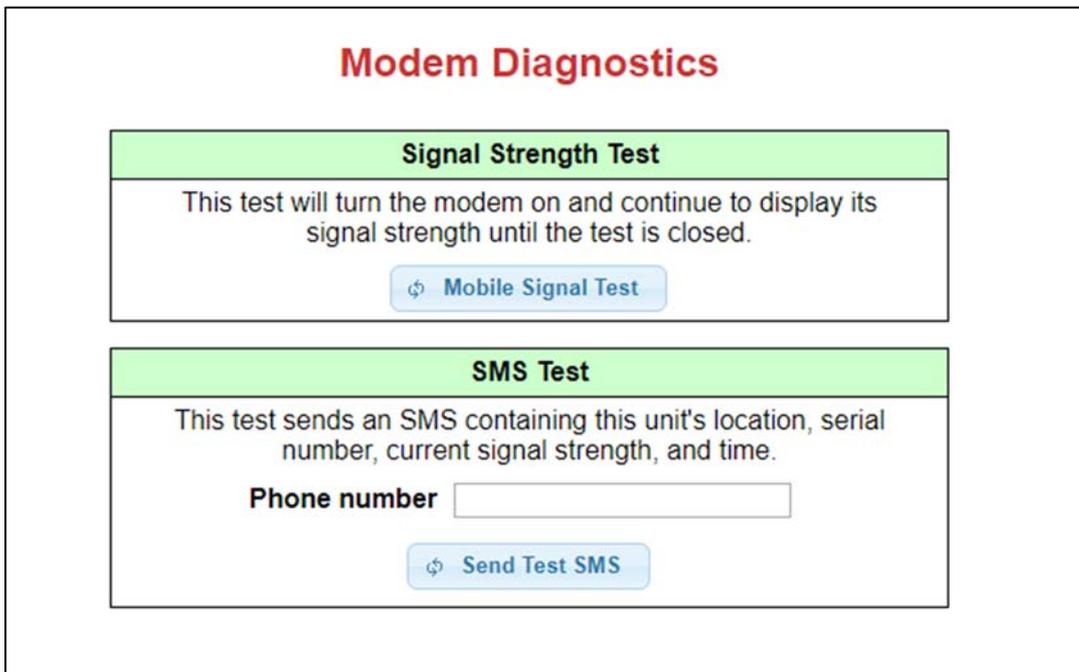
Input Channel Calibration and Test

Service mode allows inputs to be calibrated in exactly the same way as described in *Input Channel Calibration*, but adds an **Examine and Test** button:
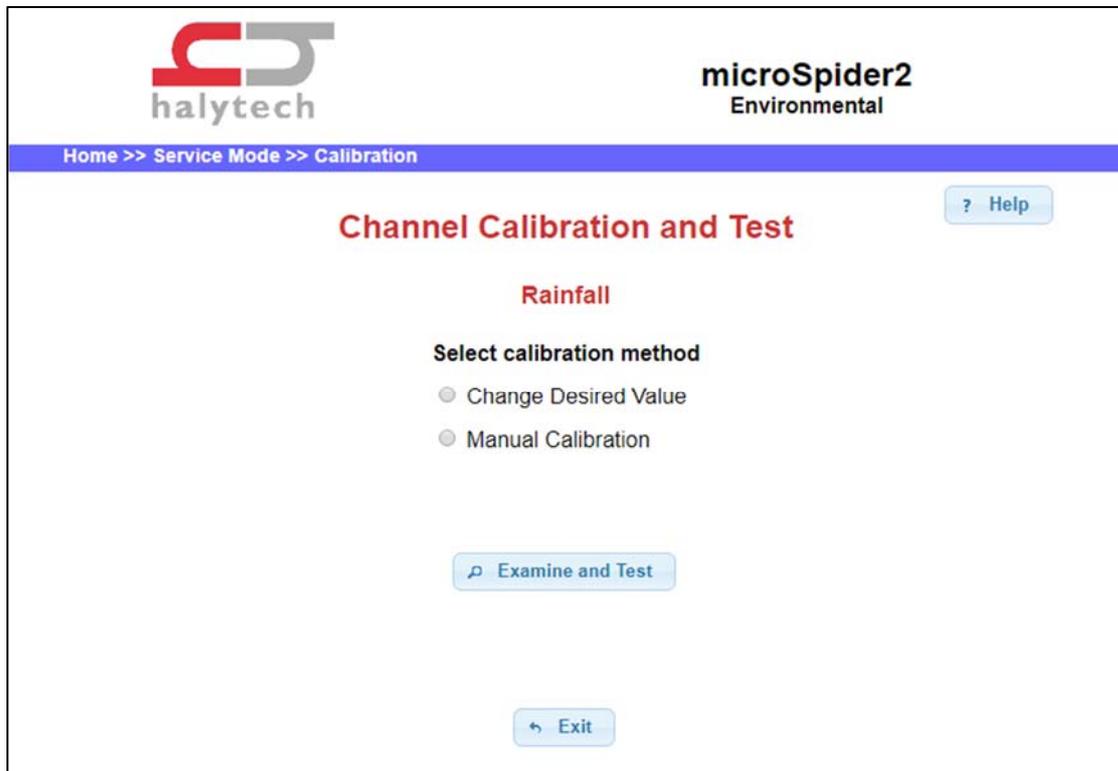
The Examine and Test button allows the user to get real-time readings from the sensor, in the same way as the magnifying glass icon available in the *Configuring Inputs* page.

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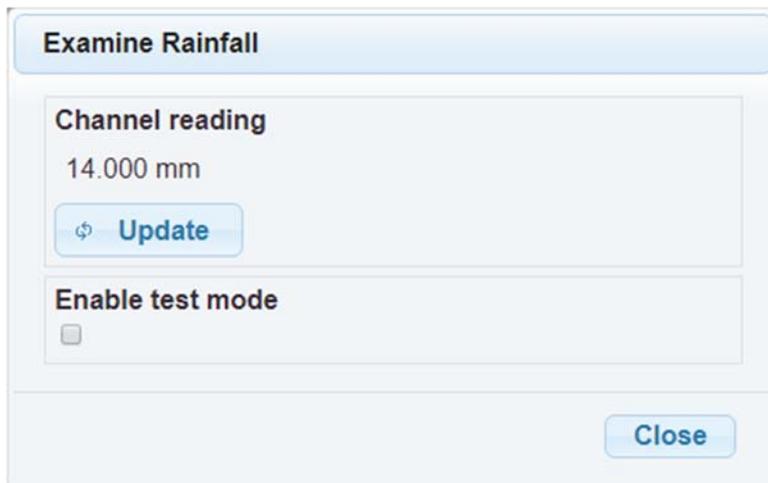
Selecting **Enable test mode** resets the displayed reading to 0, without affecting any logged data. A known number of pulses can now be input (for example, a fixed amount of water poured into a rain gauge) and the reading updated to check that the expected quantity was read.

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.

Manual Software Upgrade

The service account is able to upgrade the microSpider2's software, as described in *Local (Manual) Software Upgrade*:
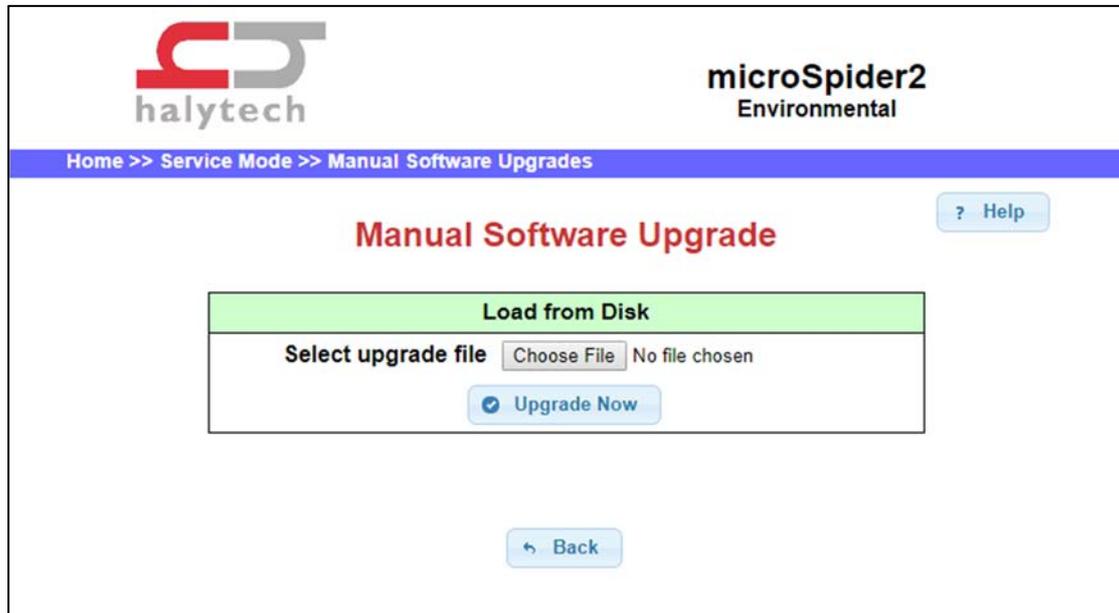
Advanced Operation

Software Upgrades

microSpider2's Software may be upgraded by four methods:

1. Loading new software via the web-browser when microSpider2 is connected to a computer. (Local/Manual Software Upgrades)
2. Upgrading from Halytech Upgrade Server (Remote Software Upgrade)
3. Upgrading from a self-managed FTP Server (Remote Software Upgrade)
4. Loading new software via DNP3 (if installed – see DNP3 (Software Option))

Local (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:
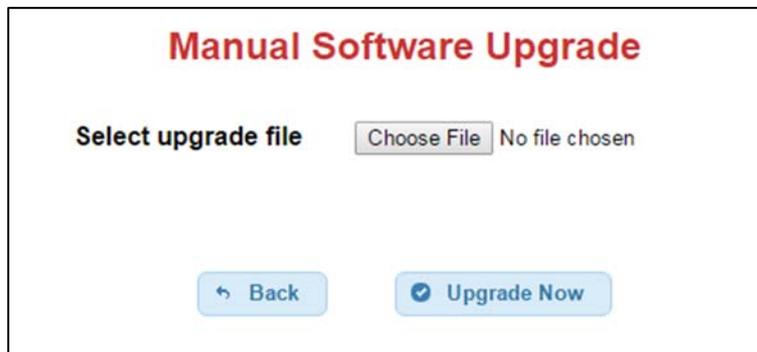
On this page, click the *Choose File* button and select the upgrade file you wish to load into the microSpider2. Next, click the *Upgrade Now* button. The microSpider2 will now receive the file from your computer and attempt to install it.

There is currently no progress indicator on this page. After clicking the Upgrade Now button, the microSpider2 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.

Remote (Automatic) Software Upgrade

Automatic software upgrades allow the microSpider2 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 microSpider2 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 microSpider2 to download when we make them available to your unit.

- **Self-Managed FTP Server:** For users who wish to manage their own upgrades, the microSpider2 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 microSpider2 to pick up.

  Each microSpider2 will request a uniquely named software file from the server. Software Files will be in the form: msf<*serial number*>.hal

Note: If you own multiple microSpiders and would like all of them to upgrade their software remotely, you will need to have separate software files for each microSpider2.

With automatic software upgrades enabled, the microSpider2 will check for new software each day after a report is sent out. If new software is found, the microSpider2 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:

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**: Select either Halytech Upgrade Server or 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 microSpider2 to download

- **Response directory**: if the microSpider2 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 microSpider2 was successful in installing the software file, and will detail any errors it encountered if unsuccessful. If the response directory is left blank, the microSpider2 will upload response files to the chosen Software directory.

Note: Automatic software updates 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.

SMS Commands

Many of microSpider2's settings may be changed remotely, and channels may be calibrated by sending commands via SMS

Each SMS message sent to the microSpider2 must begin with the microSpider2's serial number. The microSpider2 will reject the SMS message if this serial number is incorrect, and will not respond to the SMS message.

The microSpider2's serial number can be obtained by reading the label on the enclosure, the Log In page, or by looking on the *About* page.

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. However, the getrepfmt command must come after the getrep command.

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 microSpider2 will reject the entire message. You may send the microSpider2 multiple SMS messages at a time, but be aware that each must begin with the microSpider2'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 microSpider2 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 microSpider2's own serial number.

Requests for data

Command	Description
getrep	Get a report. This sends everything from the last report forwards. Specify email address. For example: 002716 getrep='joeblogs@halytech.com.au' The report will be in the same format used for automatic reports unless otherwise specified by using the *getrepfmt* command.
getrepN	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: 002716 getrep30='reports@halytech.com.au' The report will be in the same format used for automatic reports unless otherwise specified by using the *getrepfmt* command.
getrepd	Get a report that contains data from a specific date, in the format "dd/mm/yy". For example: 002716 getrepd='01/08/16 reports@halytech.com.au' to send all data recorded on 1 August 2016. An end date may also be specified, for example: 002716 getrepd='01/08/16-30/09/16 reports@halytech.com.au' 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 *getrepfmt* command.
getrepfmt	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: 002716 getrep='reports@halytech.com.au' getrepfmt='d' Note: the getrepfmt command must come after the getrep command.
getcfg	Get the current setup sent to you via email. For example: 002716 getcfg='reports@halytech.com.au' An email will then be sent to the specified address with the setup file as an attachment.

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'

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 to 5 minutes:

> 002716 log_per='5m'

User settings

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

LAN settings

Command	Description
ip_my	microSpider2 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

WAN / Internet settings

Command	Description
wan_method	Select how microSpider2 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'

Date / Time settings:

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

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)

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)

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	microSpider2's email address (the From address in emails sent by the microSpider2)

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='/microSpider/upgrades/'
> ftprdir='/microSpider/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'**

Alarm settings

Command	Description
eem_al0	Email alert enable
	0 = disabled, 1 = enabled
ad0_al0	1st Email alert address
ad1_al0	2nd Email alert address
ad2_al0	3rd Email alert address
esm_al0	SMS alert enable
	0 = disabled, 1 = enabled
ph0_al0	1st SMS alert phone number
ph1_al0	2nd SMS alert phone number
ph2_al0	3rd 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 <u>starting from 0</u>. 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'

Advanced settings

Command	Description
controlN_wutime	Control Warmup time
	N = 0 for Switched Power Out, 1 for Open Collector, 2 for Low Voltage
	Valid warmup times include '100ms', '1s', '2s', '3s', '5s', '10s', '15s', '20s', '30s', '1m', '2m', '3m', '5m' and '10m'
	E.g. control1_wutime='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

Advanced settings for LiveSMS option:

livesms   LiveSMS (0 = disabled, 1 = always on, 2 = schedule + alarms, 3 = alarms only)
mod_tim   LiveSMS schedule, 1 bit for each hour of the day (0-23). Ie: to schedule LiveSMS for hours 10:00am and 3pm (15:00), mod_tim would be:

H:23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

> Binary Representation: 000000001000010000000000
> Binary converted to decimal: 33792
> Therefore, the user should SMS: mod_tim='33792'

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 microSpider2'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='microSpider@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'

Remote SMS Calibration

Note: This section assumes you have familiarity with 'SMS Commands', the previous section in the manual.

Note 2: Remote SMS Calibration is not supported for Intelligent Sensors.

The microSpider2 allows channel offsets to be adjusted remotely by comparing logged data with known values supplied by the user. The user supplies the microSpider2 with the value of a reading as well as the time and date when that reading was taken. The microSpider2 then matches up its logged data with this reading and adjusts the 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 "cal19", which is used to calibrate channel 20

The message should be in the 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 microSpider2 and has connected an electricity meter to input channel 1. The pulse rate has been correctly calibrated within the microSpider2 to 10 pulses per kWh, however the actual reading on the meter does not match what is showing on the microSpider2.

Attempting to read the meter and update the microSpider2 via the web-browser at that exact instance may not always be possible (for example: when the meter is far from the microSpider2). 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 microSpider2 with that data, asking it to calibrate the channel:

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

When the microSpider2 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.

Response to SMS Commands
In response to a valid SMS command, the microSpider2 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 (commands) you sent in your message.

For example, in response to the message:

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

The microSpider2 with serial number 002716 and location name 'myMicroSpider' would reply with the response SMS message:

myMicroSpider: processed 2 variables.

Note: As mentioned earlier, if the serial number is incorrect, the microSpider2 will <u>not</u> respond to the SMS message.

Note: Because the microSpider2 keeps its modem off most of the time to save power, the SMS command may take some time to be received. See the section on "SMS Recovery" for more information.

LiveSMS (Software Option)

LiveSMS functionality is available as a software option for the microSpider2.

It allows the microSpider2 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 microSpider2 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: microSpider2 will leave the modem on at all times

- Schedule + Alarms: microSpider2 will leave the modem on at selected times, and when waiting for SMS alarm acknowledgement.

- Alarms Only: microSpider2 will only leave the modem on when waiting for SMS alarm acknowledgement.

Note: If LiveSMS is set to Always, SMS Recovery (see: Network page) 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 ALxx	Acknowledge Alarm x (x is 1 - 16)	ACK AL6
ACK ALL	Acknowledge All Alarms	ACK ALL
ON CNx	Activate Control x (no PIN)	ON CN2
yyyy ON CNx	Activate Control x (PIN = yyyy)	1234 ON CN2
OFF CNx	Deactivate Control x (no PIN)	OFF CN2
yyyy OFF CNx	Deactivate Control x (PIN = yyyy)	1234 OFF CN2
PULSE CNx	Pulse Control x for 1 second (no PIN)	PULSE CN2
yyyy PULSE CNx	Pulse Control x for 1 second (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 H) (PIN = yyyy)	1234 GPRS 5,me@example.com

For the Control commands, such as ON CNx:

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

After a microSpider2 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 microSpider2 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 microSpider2 while the modem is off, they will be received next time it turns on.

- If LiveSMS is disabled, microSpider2 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 LiveSMS 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, microSpider2 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 LiveSMS is enabled.

The Escalation time is the period of time (in minutes) during which an alarm must be acknowledged to stop the microSpider2 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

Controlling another unit via SMS

The microSpider2 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 Out and 4 = SDI-12 Command

To control a remote unit, LiveSMS must be enabled on the local microSpider2 and an alarm must be 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 microSpider2 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 microSpider2 units.

The local microSpider2 unit is measuring a water level, and a pump is controlled by the remote microSpider2.

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.

An alarm would be setup on the local unit as illustrated on the next page.

Change Alarm 'Pump ON'

Alarm name	Pump ON
Trigger source	Analogue 3: Water Level ▼
Trigger level	Below ▼ 1.000
Qualifying time	0 second(s)
Control action	Disabled ▼
Log action	☐ Log additional channel
Send alarm report	Disabled ▼
Fast logging	☐
Message	ON REM1
Auto acknowledge	☑
Auto acknowledge time	60 minute(s)

SMS Alerts ☑	
1st phone number	0412345678
2nd phone number	0412345678
3rd phone number	
Escalation time	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 microSpider2.

If the remote microSpider2 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 microSpider2. 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 microSpider2's escalation time is set to 3 minutes. If it does not receive an acknowledgement from the remote microSpider2 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 microSpider2 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 microSpider2 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.

DNP3 (Software Option)

Distributed Network Protocol (DNP3), available as a software option, allows a microSpider2 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 microSpider2 complies with the level 2 subset of the DNP3 protocol (DNP3-L2).

To support low-power operation, the microSpider2 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.

DNP3 communications settings

The microSpider2 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 microSpider2 will listen for an incoming connection from the DNP3 server. The SCADA system must be configured to connect to the microSpider2's IP address on the Ethernet LAN.

More commonly, the microSpider2 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	
Server IP address 2	
Server IP address 3	
Server port	20000
Local DNP3 address	4
Server DNP3 address	3
Status	disabled

Save and Restart DNP3

Note: to enable DNP3, enter at least one server address or select listen in advanced settings

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 microSpider2 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.

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 master[5]. When a LAN connection is used, these events are sent continually, as each input 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.

---

[5] 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 ☑		
Report all logged data ☑		
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 microSpider2 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 DNP3 event 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. Eg: 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 should 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.

DNP3 alarms

When using a modem to connect to the DNP3 server, the microSpider2 can periodically update the server, as described above.

However, you may need your 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:

When the alarm becomes active, the microSpider2 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 microSpider2 sends data about changed inputs to the DNP3 master. When a DNP3 alarm occurs on the microSpider2, 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 whilst the alarm is active, select the "**Repeat (fast period)**" dropdown menu option. The microSpider2 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.

DNP3 input point mapping

A microSpider2 can have up to twenty input channels, numbered from 1 to 20, 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 microSpider2, it's necessary to understand how the microSpider2's input channels correspond to DNP3 input points.

The following table lists the microSpider2 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 microSpider2 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 increase until they are reset, after which they continue to count up.

However, the microSpider2 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 microSpider2 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.

microSpider2 channel numbers start from 1, while DNP3 point indexes start from 0.

Therefore, subtract 1 from the channel number to get the corresponding point index:

> Channel 1 = point 0
>
> Channel 2 = point 1
>
> Channel 3 = point 2
>
> Channel 20 = point 19

For example, with the following input setup:

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.

DNP3 output point mapping

A microSpider2 provides three 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).

The microSpider2's controls are binary outputs.

As with input points, each type of output point is indexed, starting from 0.

The microSpider2's controls are mapped to DNP3 output points, as follows:

microSpider2 Control	DNP3 binary output point index
Switched Power Out	0
Open Collector	1
Low Voltage Out	2
SDI-12 Command	3

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 microSpider2 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.

Setting the clock

DNP3 can be used to set the microSpider2's date and time.

The microSpider2 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 microSpider2's clock, there is no need to also use NTP (but it doesn't hurt to use both).

Resetting the microSpider2

DNP3 can be used to remotely reset (reboot) the microSpider2.

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 microSpider2. This is the same as turning the microSpider2 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 level 2 DNP3 standard.

Reading device attributes

The microSpider2 is able to report a number of "device attributes" via DNP3.

These include the software version, serial number, long and short location names, the product name ("microSpider2") and hardware version: '30' for a microSpider2 Environmental, or '31' for a microSpider2 Industrial.

This allows you to correctly identify your microSpider2 unit in the SCADA system.

Transferring setup files and software upgrades

DNP3's file transfer functionality can be used to

- Read the microSpider2's current configuration and save it as a setup file

- Write a setup file to the microSpider2, to update its configuration

- Upgrade the microSpider2'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 Setting User and Password) 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 microSpider2'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 currently active microSpider2 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 Manual Setup Management).

The name of the setup (or configuration) file on the microSpider2 is in the form:

msc*<serial number>*.cfg

For example, if your microSpider2's serial number is 000D98, the DNP3 server should request a read of the file named msc000D98.cfg on the outstation.

(The same filename is used in automatic setup updates – see 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 microSpider2'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 microSpider2 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 K: 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:

Download File

Operation will be applied to:
microSpider.microSpider2

Source Filename	c:\temp\config.txt
Destination Filename	msc000FB2.cfg
Activate	☑

OK   Cancel
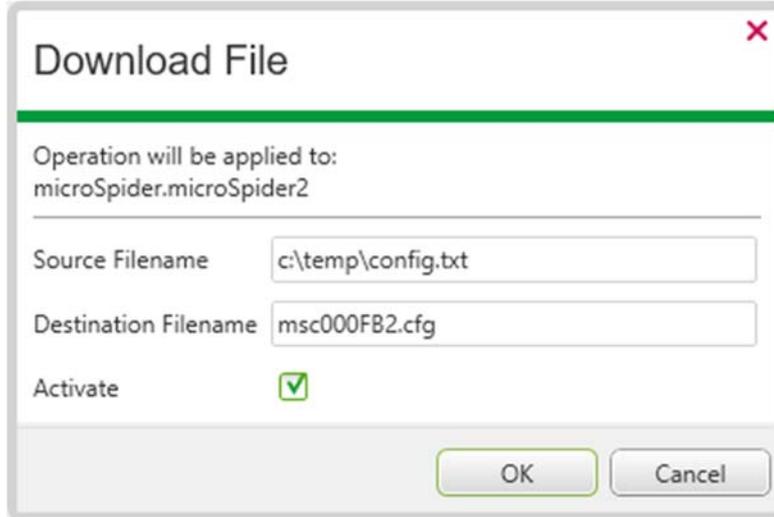
Software upgrades

To upgrade the microSpider2'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 microSpider2 is in the form:

msf*<serial number>*.hal

For example, if your microSpider2's serial number is 000D98, the DNP3 server should write to the file named msf000D98.hal on the outstation.

(The same filename is used in automatic software upgrades – see Remote (Automatic) Software Upgrade).

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 microSpider2 will then reboot to install the software upgrade, a process that will take up to 90 seconds.

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	☑
Send Level 2 Responses Only	☐
Event Buffer Size	65535
Unsolicited Confirm Timeout	default
Unsolicited Retry Delay	default
Unsolicited Offline Delay	default
Unsolicited Max Retries	default
Restore DNP3 Defaults	

The following options are available:

- **Listen Mode**: Specifies the connection mode

    o **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).

    o **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 microSpider2'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 A: microSpider2 Inputs

INPUT TYPE	LOGGING METHOD	LOGGING RESOLUTION	ALARM TRIGGER CHOICES	TYPICAL USE	COMMENT
SWITCH	AUTOMATIC	Within 3 s of change	ON STATE OFF STATE	Switches, Status indicators, level (float) switches	Must be stable for a minimum of 3 s. Current state recorded every midnight.
EVENT	AUTOMATIC	Within 1 s of pulse	RATE OF CHANGE	Tipping bucket rain gauge, any sensor outputting less than 1 pulse per 30 s with a minimum pulse width of 0.01 s	Logs time of pulse **and** pulse counter that rolls over from 999,999 to 0. Current count recorded as a special event every midnight
EVENT (DAILY TOTAL)	AUTOMATIC	Within 1 s of pulse	RATE OF CHANGE	Tipping bucket rain gauge, any sensor outputting less than 1 pulse per 30 s with a minimum pulse width of 0.01 s	EVENT type with "Periodic reset" = 24 hours. Logs time of pulse **and** pulse counter that rolls over from 999,999 to 0. Current count cleared and recorded every midnight
COUNTER	SIGNIFICANT CHANGE	AS SET BY USER (SCAN PERIOD)	RATE OF CHANGE	Pulse type flow meters, any sensor with a low frequency (<= 100Hz) output	Counter rolls over from 999,999 to 0. Current count recorded every midnight.
COUNTER (UTILITY METER)	EVERY SCAN PERIOD	AS SET BY USER (SCAN PERIOD)	RATE OF CHANGE	Water, electricity or gas meters. Any pulse type meter with a low frequency (<= 100Hz) output	COUNTER type with "Log difference in reading" enabled. Each logged data point is the number of pulses in the previous scan period.
ANALOGUE	SIGNIFICANT CHANGE	AS SET BY USER (SCAN PERIOD)	ABOVE BELOW RATE OF CHANGE	Most voltage and current sensors: temperature, pressure, signal strength etc.	12-bit resolution. Current value recorded every midnight.
QUADRATURE	SIGNIFICANT CHANGE	AS SET BY USER (SCAN PERIOD)	RATE OF CHANGE	Rotary or shaft encoders, any sensor with quadrature (two phase) pulse outputs	Counter rolls over from 999,999 to −999,999 Current count recorded every midnight.
SYSTEM MONITORS	SIGNIFICANT CHANGE	AS SET BY USER (SCAN PERIOD)	ABOVE BELOW RATE OF CHANGE	Built-in system monitors: external power voltage, battery voltage and system temperature	12-bit resolution. Current value recorded every midnight.
DISABLED	-	-	-	-	Disabled inputs are removed from all display screens.

Appendix B: Raw / Diagnostic / User ID Report File Formats

microSpider2 logs data internally in an efficient binary format.

The internal binary format is converted into a standard "CSV" (Comma separated values) file before each download. A CSV file is readable by most spreadsheet and database programs.

This appendix provides information about the structure of the "CSV" file when downloaded in 'Raw', 'Diagnostic', 'Diagnostic Only' or 'User ID' format.

Each record in the Raw and Diagnostic file consists of five (raw) or six (diagnostic) fields:
1. record date e.g. 14/05/03
2. record time e.g. 12:34:15
3. record numeric identifier (CATEGORY) – see table below
4. record numeric identifier (IDENTIFIER) – see table below
5. record text description or in the case of analogue and counter inputs, the value of the input
6. inputs with "Log difference in reading" enabled will log the 'totalized' or absolute value in the 6th column (only included in diagnostic reports)

'Diagnostic Only' reports have the same format (as above), but exclude the logged channel data. They contain only system messages and diagnostic codes that are useful to Halytech when resolving an issue.

Each record in the User ID report type consists of four fields:
1. record date e.g. 14/05/03
2. record time e.g. 12:34:15
3. If the record is for an *Input*, this field will display the User ID selected by the user for that channel – see Configuring Inputs.
   Otherwise, this field will display the Identifier listed in the table below. 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.
4. record text description or in the case of analogue and counter inputs, the value of the input

Special Cases for the User ID report are handled in a similar fashion to the Filtered Reports (Appendix C):

1. When a "Switch" Input changes from ON to OFF, the period of time it was ON is logged. This is recorded in the User ID report as:
   (date),(time),(User Defined ID)_run,(time switch was on).

2. At midnight when inputs are logged, they will be logged as:
   (date),(time),(User Defined ID)_reading,(input value).
   Note: if "Log difference in reading" is enabled this will be the total channel count or absolute value.
3. If min/max logging is enabled for an Analogue channel, the maximum log will be displayed in the User ID report as:
   (date),(time),(User Defined ID)_max,(input value).
4. If min/max logging is enabled for an Analogue channel, the minimum log will be displayed in the Filtered report as:
   (date),(time),(User Defined ID)_min,(input value).

The 'User ID (with controls)' format is identical to the 'User ID report', except that it also includes records specifying the time that each control turns on or off, with the text description "ON CN#" or "OFF CN#", where '#' is the control number (0 is Switched Power Out, 1 is Open Collector and 2 is Low Voltage Out).

The following table lists the values for the numeric identifier and text fields found in raw and diagnostic reports.

(Diagnostic reports may also include additional records using internal codes used by Halytech engineers to diagnose issues, and so are not listed here.)

TYPE	CATEGORY RANGE	CATEGORY CONTENT	IDENTIFIER RANGE	IDENTIFIER USE	TEXT / VALUE
Input	0-999	0 + Input #	0-65535	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
System	1000		0	microSpider2 turned on	POWERON
			10	SRAM has been reset to defaults	SRAMRST

				11	SRAM has been upgraded to a new version	SRAMUPG
				50	Logfile has been erased	LOGERASE
				100	Device is rebooting to install an upgrade	REBOOTRQ
				101	Device is rebooting as webserver requested it	REBOOTRQ
				200	Clock has been reset to 1/10/2010	CLKRST
				201	Clock has been reset to the time of the most recent logfile record	CLKRST
				300	Clock Change (last record written before changing the clock)	CLKCHG
				301	Clock Change (first record written after changing the clock)	CLKCHG
				400	Software Upgrade was successfully installed	UPG OK
				401	Software Upgrade failed installation	UPG FAIL
				402	Software Upgrade was cancelled because microSpider2 is already running the most recent software (Halytech Update Server only)	UPGNONEW
				500	System Setup was successfully installed via FTP	CFG OK
				501	System Setup failed installation via FTP	CFG FAIL
				502	System Setup was successfully installed via Web Browser	CFG OK
				503	System Setup failed installation via Web Browser	CFG FAIL
				550	Config was emailed successfully	CFGEMLOK
				551	Config e-mailing failed	CFGEMLFL
				1000-1999	+ Input # - count was reset	INP RST
				2000-2999	+ Input # - was calibrated	INP CAL

			3000-3999	+ Input # - was calibrated remotely via SMS	INP RCAL
			10000	Admin entered into 'Change Setup'	ENTRSETP
			10001	Admin left 'Change Setup'	EXITSETP
			10100	LAN connected / turned on	LANON
			10101	LAN disconnected / 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
Output / Control	2000-2999	2000 + Control # 2000 = Switched Power Out 2001 = Open Collector 2002 = Low Voltage Out	0	Output off	OFF CN#
			1	Output on	ON CN#
Alarm	3000-3999	3000 + Alarm #	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 100x SMS # + Attempt #	ALSMS OK
			20000-29999	Alarm SMS Failed 100x SMS # + Attempt #	ALSMS FL
			30000-39999	Alarm Email Sent OK Attempt # (e-mails are sent to all recipients at the same time)	ALEML OK
			40000-49999	Alarm Email Failed Attempt # (e-mails are sent to all recipients at the same time)	ALEML FL
			50000-50099	Alarm Tweet Sent OK Attempt #	ALTWT OK
			50100-50199	Alarm Tweet Failed	ALTWT FL

				Attempt #	
Report	4000-4999	4000 + Report #	10000-19999	Report FTP Upload OK Attempt #	R FTP OK
			20000-29999	Report FTP Upload Failed Attempt #	R FTP FL
			30000-39999	Report Email Sent OK Attempt #	R EML OK
			40000-49999	Report Email Failed Attempt #	R EML FL
Response	5000-5999	Response Type 5000 = Upgrade 5001 = Setup	10000-19999	Response FTP Upload OK Attempt #	RSPFTPOK
			20000-29999	Response FTP Upload Failed Attempt #	RSPFTPFL
Modem	6000		0	Modem turned on	MODEMON
			1	Modem turned off	MODEMOFF
			100	Modem signal strength (%)	Signal Strength %
			101	Modem signal strength (dBm)	Signal Strength dBm
			102	Modem signal strength (raw value)	Signal Strength
			200	Connection to GPRS Failed	GPRSFAIL
			300	Received an SMS	Last 8 digits of the sender's telephone number
		Only available if LiveSMS Enabled	700 = Alarm 1 701 = Alarm 2 … 715 = Alarm 16	SMS Acknowledge received for a single Alarm x = Alarm number (1-16)	SMS ALxK
			718	SMS Acknowledge received for all alarms	SMS ALLK
			719	SMS Acknowledge received for invalid alarm number	SMS AL?K
				SMS turned OFF control	SMS CxOF

			720 = Switched Power Output OFF 721 = Switched Power Output ON 722 = Open Collector Output OFF 723 = Open Collector Output ON 724 = LV Out OFF 725 = LV Out ON	SMS turned ON control x = Control Number (1 = Switched Power Out, 2 = Open Collector, 3 = Low Voltage Out, 4 = SDI-12)	SMS CxON
			758	Incorrect SMS Pin Number given, could not process SMS	SMS BPIN
			759	Incorrect control number given for turning OFF control	SMS C?OF
				Incorrect control number given for turning ON control	SMS C?ON
			760	Received GET ST command via SMS	SMS GTST
			761	Received GET CN command via SMS	SMS GTCN
			762	Received HELP command via SMS	SMS HELP
			763	Received GET AL command via SMS	SMS GTAL
			764	Received GET REP command via SMS	SMS GTRP
			796	Received invalid SMS command	SMS INV
			797	Reply SMS message sent OK	SMS REOK
			798 = Attempt 1 799 = Attempt 2 800 = Attempt 3	Reply SMS message sending failed	SMS REFL
			860 = Switched Power Output Pulse 861 = Open Collector Output Pulse 862 = Low Voltage Out Pulse	SMS performed 1s pulse output x = Control number (1 = Switched Power Out, 2 = Open Collector Out, 3 = Low Voltage Out)	SMS CxPS
Services	7000		0	NTP Updated the System Clock	NTP OK

			1	NTP Failed	NTP FAIL

Appendix C: Filtered Report File Format

The filtered file format is a simplified version of the logged file.

It contains only logged input values in a standard "CSV" (Comma separated values) format.
A CSV file is readable by most spreadsheet and database programs.

This appendix provides information about the structure of the "CSV" file.

Each record in the file consists of four fields:

1. input name e.g. Temperature
2. record date and time e.g. 23-Jan-06 13:00:00
3. input value e.g. 123.445

There also exist four special cases:

1. When a "Switch" Input changes from ON to OFF, the period of time it was ON is logged. This is recorded in the filtered report as:
   (input name)_run,(date:time),(time switch was on).

2. At midnight when inputs are logged, they will be logged as:
   (input name)_reading,(date:time),(input value)
   Note: for channels with "log difference" enabled this will be the running total or absolute value of the channel.

3. If min/max logging is enabled for an Analogue channel, the maximum log will be displayed in the Filtered report as:
   (input name)_max, (date:time),(input value)

4. If min/max logging is enabled for an Analogue channel, the minimum log will be displayed in the Filtered report as:
   (input name)_min, (date:time),(input value)

Appendix D: Multi Column Report File Format

The multi column file format is a simplified version of the logged file, with many records omitted and a different layout to all other report formats. This style of report includes a header row to indicate the use of each column.

It contains only logged input values in a standard "CSV" (Comma separated values) format. A CSV file is readable by most spreadsheet and database programs.

This appendix provides information about the structure of the "CSV" file.

Each record in the file consists of the following fields:

1. Record date and time e.g. 23-Jan-06 13:00:00
2. Input values for all channels (includes system channels and Intelligent Sensors)
3. Modem Signal Strength

Midnight logs, switch-on duration, min/max logs and other 'information' messages are omitted in this style of report.

If multiple events occur at the same time on the same channel, only the most recent is recorded – for instance an "event counter" records 3 pulses in 1 second, only the count after the 3rd pulse will be shown in the multi-column report.

Channels which were not logged at that time will appear as blank columns.

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 me 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 E: Custom Report File 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.

It contains only logged input values in a standard "CSV" (Comma separated values) format.
A CSV file is readable by most spreadsheet and database programs.

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 F1: Connecting microSpider2 Environmental to your PC

1. You must use the special microSpider2 Communications "LANlink" Y-cable.

2. Turn your computer on and disconnect it from your network.

3. Plug the round connector end of the cable into the communications connector of the microSpider2. (When viewed from the front, the communication connector is on the left.)

4. Connect the Y-end of the cable into your computer by plugging the RJ-45 connector into the LAN port and plugging the USB connector into a free USB port.

5. Wait 15 seconds.

6. Open a browser program on your PC and request the following page:
   http://192.168.0.177

7. The microSpider2 Login page will be displayed

8. Log in, User Name is "user" and Password is "changeme" (without inverted commas)

9. The Alarms page will be displayed

   Please note: while your PC is connected as described above, it will supply the power to the microSpider2 but Therefore, there is no need to minimise PC connection times – the internal battery pack will be unaffected, by their duration. The only exception to this is modem operation. The internal battery pack is always supplying the power to the modem. (You will be notified in your browser when the modem is turned ON.)
The microSpider Lite does not have this feature so requires its working internal battery.

IN CASE OF DIFFICULTY

If you cannot connect to a microSpider2, check the following settings in your browser (Internet Explorer 11 is described here, other browsers are similar):

1. Disable automatic dialing (In IE11: Tools->Internet Options->Connections, select "Never dial a connection")

2. Disable proxy servers (IN IE11: Tools->Internet Options->Connections->LAN Settings, uncheck "Use a proxy server for your LAN")

3. If you changed any browser settings, quit and restart your browser

If you still cannot connect to a microSpider2, refer to Appendix G for more information.

Appendix F2: Connecting microSpider2 Industrial to your PC

1. Disconnect your computer from your network and turn it on.

2. Connect one end of the red crossover LAN cable into the "LAN" connector of the microSpider2.

3. Connect one end of the white USB cable into the "USB" connector of the microSpider2.

4. Connect the other end of the LAN cable into your computer LAN port.

5. Connect the other end of the USB cable into a free USB port on your computer. (No drivers are required nor will be installed.)

6.   Wait 60 seconds.

7. Open a browser program on your PC and request the following page: http://192.168.0.177

8. Log in, User Name is "user" and Password is "changeme" (without inverted commas)

9. The Alarms page will be displayed

NOTE: Steps 3 and 5 are not required for microSpiders with their LAN port mode selector set to "PWR". Please refer to the "LAN Power Selector" section earlier in this document for more details.

IN CASE OF DIFFICULTY

If you cannot connect to a microSpider2, check the following settings in your browser (Internet Explorer 11 is described here, other browsers are similar):

1. Disable automatic dialing (In IE11: Tools->Internet Options->Connections, select "Never dial a connection")

2. Disable proxy servers (IN IE11: Tools->Internet Options->Connections->LAN Settings, uncheck "Use a proxy server for your LAN")

3. If you changed any browser settings, quit and restart your browser

If you still cannot connect to a microSpider2, refer to Appendix G for more information.

Appendix G: Local Area Network (LAN) Configuration

microSpider2 uses standard TCP/IP protocols for all communications. No special procedure is required to contact a microSpider2 except to ensure that the microSpider2 and your network and/or PC have matching network parameters.

Your computer must have a network adapter installed and working correctly. If this is not the case, install a network adapter by following its manufacturer's instructions.

Option 1 - Connecting a PC Directly to a microSpider2

The following procedure assumes that the following is true:

- "EASY CONNECT" on the microSpider2 is enabled. (microSpiders are shipped from the factory with "EASY CONNECT" enabled.)

- Your PC is setup to automatically get an IP address from the network. (Most PC's are set up in this way by default.) You can check this setting by following the "Automatic IP Address Checklist" later in this Appendix.

Connect your PC to the microSpider2 as described in Appendix F1 or Appendix F2.

Automatic IP Address Checklist for Your PC

Windows 7 / 8 / 10:

1. Click on the 'Start' icon->"Control Panel"->"Network and Internet"->"Network and Sharing Center"->"Change Adapter Settings"
2. 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.
3. Right click on the item "Local Area Connection" and select "Properties".
4. Near the bottom of the new window click on "Internet Protocol (TCP/IP)" and then click on "Properties"
5. Select "Obtain an IP address automatically"
6. Select "Obtain DNS server address automatically"
7. Click OK
8. Click OK
9. Close the Network Connections window

Option 2 - Connecting to an Existing Network (LAN)

Before connecting the microSpider2 to an existing network, contact your network administrator and obtain a free static IP address and a corresponding mask.

If the default settings are not supported by your network (IP: 192.168.0.177, Subnet: 255.255.255.0), you will first need to connect the microSpider2 to your PC directly in order to change the microSpider2's settings.

Once connected directly to the microSpider2, adjust the IP address and Subnet to those provided by your network administrator through the web browser as described in the section "Setting up a microSpider2 for the First Time -> Setting Up Network Parameters"

Once finished, connect the microSpider2's Ethernet cable to a 'straight-through' adapter, then connect the 'straight-through' adapter to your network.

You can then connect to the microSpider2 from any computer on your network by starting the computer's browser and typing the IP address of the microSpider2 into the browser's address bar.

NOTE: You should also disable the EASY CONNECT network setting on the microSpider2 as described in the section "Setting up a microSpider2 for the First Time -> Setting Up Network Parameters"

Appendix H: Connecting to a microSpider2 Remotely (LiveSMS only)

If you have the LiveSMS software option, you can connect remotely to the microSpider2:

1.   Send this SMS command to the microSpider2:

> 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 microSpider2 will respond with an SMS acknowledging your message.

3.   The microSpider2 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 displayed[6]. 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 microSpider2 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.

---

[6] 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.

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 needs to be set to "telstra.extranet" (see Modem settings)

3. The E-mail settings need to be set up correctly (see Setting up E-mail Parameters)

    IMPORTANT: It is strongly advised that you confirm that all settings affecting e-mails are correct, by sending a test e-mail as described in Setting up E-mail Parameters.

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 LiveSMS).

All of the microSpider2'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 I: Alarm Status Codes

SMS alerts

When an alarm is sending out SMS alerts, the status of the alerts is shown on the Alarms status page. The status codes have the following meanings:

Code	Meaning
1	1st attempt to 1st phone number
2	2nd attempt to 1st phone number
3	3rd attempt to 1st phone number
4	1st attempt to 2nd phone number
5	2nd attempt to 2nd phone number
6	3rd attempt to 2nd phone number
7	1st attempt to 3rd phone number
8	2nd attempt to 3rd phone number
9	3rd attempt to 3rd phone number
10	The microSpider2 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.

Email alerts

When an alarm is sending out email alerts, the status of the alerts is shown on the Alarms status page. The status codes have the following meanings:

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

Twitter alerts

When an alarm is sending out a twitter alert, the status of the alert is shown on the Alarms status page. The status codes have the following meanings:

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

Appendix J: Power Considerations

Under typical conditions a microSpider2 Environmental (or microSpider2 Industrial running on external batteries) can run for several 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 microSpider2 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 the Counter channel type.

Appendix K: Setup File Format

Any setup file loaded into a microSpider2 must be formatted correctly. This section describes these requirements.

1. **Header**
    The first three lines of the file must be:
    . MICROSPIDER2
    .DEV=*<device code>*
    .VER=*<version number>*

    Where *<device code>* must match the microSpider2's device type and *<version number>* must match or be less than the software version currently running on the microSpider2. If the device code or version number is incorrect, the configuration file will be rejected.

    The device codes for the various microSpider2 models are as follows:

Device Type	Device Code
microSpider2 Environmental	30
microSpider2 Industrial	31
microSpider2 Environmental Satellite	32
microSpider2 Industrial Satellite	33

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 L: Rating Table File Format

The rating table is a CSV file consisting of at least three columns.
These can be in any order and the file can include additional columns but three of the columns must have the following fixed headings:

- STAGE as the input
- DISCH as the output
- TABLE as the source table, this will be used to identify the uploaded table

If the CSV file does not contain these three columns the device will reject the CSV file and warn the user of an unsuccessful update.

A maximum of 100 data rows is supported.