Spider AMR

Compact Low Power Automatic Meter Reading System

USER MANUAL

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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.

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Introduction

Halytech Spider AMR is designed for monitoring large numbers of utility meters; including water, gas and electricity. It is an integrated monitoring, control and alarm system suitable for remote, low power, battery powered applications.

It can monitor various inputs, control outputs, generate alarms and log. Spider AMR is a complete system. It includes all software, hardware and a cellular phone module. Setting up and interrogating a Spider is a simple matter of viewing pages with any standard web browser. A Spider can be accessed either locally via a direct cable connection or remotely via a modem or by sending and receiving SMS messages.

NO SOFTWARE MODIFICATIONS ARE REQUIRED TO CATER FOR DIFFERENT APPLICATIONS.

The Spider AMR is a specialised version of the Spider SMS system. It adds support for large numbers of wireless sensors, greatly reducing costs and simplifying installations.

Spider AMR is suitable for use by system integrators and OEM applications. It is housed in a compact plastic enclosure, which must be mounted inside a dustproof (or if required - weatherproof) enclosure provided by the user.

Users requiring a single box solution may consider the ENC-01. It is a weather proof, powder-coated steel enclosure designed specifically for the Spider device and its accessories.

Typical Applications

- Automatic meter reading
- Water audits
- Process Control
- Water Treatment
- Waste Management
- Irrigation

System Overview

Each Spider AMR incorporates an industrial controller, input/output interface, a logger, a cellular phone interface (both GSM and NextG types are available) and a battery management system with solar panel / mains charger support.

Spider AMR is capable of:
1. Monitoring up to eight (8) user inputs
2. Monitoring up to three (3) system inputs
3. Monitoring up to one hundred (100) wireless transmitters (up to 400 meters)
4. Controlling up to eight (8) controls
5. Generating up to eight (8) alarms
6. Sending SMS messages
7. Receiving SMS commands
8. Sending e-mails (optional)
9. Logging input, control and alarm activity
10. Sending automatic daily reports via e-mail and FTP (optional)
11. Being configured by the user through a standard web browser

Inputs

A Spider accepts two different types of inputs – native and wireless.

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

Wireless inputs are supported through an external wireless interface.

Native (Hardwired) Inputs

Native inputs are connected to the Spider AMR via two multi-pole connectors. Each multi-pole connector accepts four inputs. They are labelled INPUT1 to INPUT8 and each is provided with two screw terminals. Wire sizes up to 1.5 mm^2 may be used. Each input can be configured by the user for operating in one of the following five 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 two terminals together, while the inactive state is indicated by the terminals staying open. A switch state must be stable for a minimum of 5 seconds to be recognised.

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

2. "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

3. "COUNTER"
    Count will increment each time the terminals are shorted. Frequencies up to 10Hz are supported. The counter will roll-over from 99,999 to 0.

4. "UTILITY METER"
    This type of input records the number of pulses in a logging period. It is typically used to record readings from water, electricity and gas meters.

5. "DISABLED"
    This mode disables the input. The input is removed from all reports and menus.

The user can tailor the system by assigning application specific input names. So for example Input 1 may be called "PUMP 3 OK" etc.

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

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

Wireless Inputs

Wireless sensor system comprises of two components: a wireless receiver and 1 to 100 wireless transmitters.

The receiver connects directly to a Spider AMR - the Spider supplies all necessary power to the receiver. The receiver is supplied with a standard, compact whip aerial. Higher gain aerials with extension cables are available from Halytech or its distributors. Please refer to "Physical Connections" section for details.

Each transmitter is a self-contained, waterproof module that connects directly to the device to be monitored (for example a water meter).Transmitters are available in three different versions: with built-in long-life batteries, replaceable batteries or transmitters that can be powered by mains power.

In order to maximise the transmitter battery life, a Spider polls each transmitter only when required by making use of limited datalogging capability built into the transmitters. Manual polls can be initiated by the user as required to facilitate installation and servicing, and the Spider will also trigger a poll before a report is sent so that the returned data is up to date.

The expected battery life of a transmitter depends on many factors such as the type of transmitter, the total number of transmitters and repeaters in range, the logging period and signal conditions. It is generally measured in years, but contact Halytech for an estimate.

Under ideal conditions the signal between the Spider and transmitter has a range of 1km line-of-sight. Any obstructions or other radio equipment in between will lower the range, though the severity depends on the obstruction. In general materials such as brick and dry wood have little impact on the signal. Materials like metal, plant foliage and earth (e.g. a hill) have a large impact. Concrete can have an impact if it has metal reinforcement.

We recommend that the Wireless Diagnostics be used to verify that the signal strength is at least **50%** at the time of install to allow for changed conditions. The transmitters will function well until about 30%; below this point data may be lost.

If the signal is low, up to 3 additional transmitters can be used as repeaters to boost the signal. Under ideal conditions the total range is therefore 4km. Repeaters are particularly useful to go around obstructions.

EXAMPLE: While each leg of the transmission is line-of-sight a repeater can be used to change the direction of the signal

Several different versions of wireless transmitters are available to monitor different types and numbers of inputs. Some are described below, but contact Halytech for a complete list.

Transmitter Type	Spider Input Type	Compatible Sensors	Example Application
WaveFlow	Wireless Counter Wireless Utility	Pulse Outputs e.g. Dry Switch Contact, Open Collector	Electricity, Gas and Water metering Rain Gauge
WaveSense 4-20 mA	Wireless Analog	4-20 mA loop analog	Pressure Sensor
WaveSense 0-5V	Wireless Analog	Voltage outputs	Humidity Sensor
WaveTherm	Wireless Analog	Built-in temperature	Air Temperature

System Monitors

Each Spider AMR is fitted with 3 System Monitors:

1. System Temperature – measures temperature inside the Spider AMR enclosure
2. Battery Voltage – measures the voltage of an external battery connected to the battery connector
3. Battery Charger Status – gives current state of battery charger (either ON or OFF)

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

Controls

Spider AMR provides 8 controls on two multi-pole connectors. Each multi-pole connector accepts four controls. Controls are labeled CN1 to CN8 and each is provided with two screw terminals internally connected to a relay. In inactive state the two terminals are open-circuit. Upon activation, the relay switches and the terminals are shorted together. Controls can be activated manually or by an active alarm.

The user can tailor the system by assigning application specific names to the controls. So for example Control 3 may become "VALVE 4 ON" etc.

Controls can be controlled in three ways:
1. By accessing the "Controls" page with a browser and clicking on the ON/OFF buttons
2. By sending control SMS messages to the unit
3. By programming alarms to activate or deactivate controls

It is possible to use all three forms of control simultaneously. A manual control command received either via the browser or by SMS has the lowest priority.

Controls driven by an alarm have the highest priority, overriding the manual control. Furthermore, if two or more alarms attempt to drive a control in opposite senses, the "OFF" command will override the "ON" command.

Alarms

Spider AMR can generate up to 8 alarms.

Upon activation, an alarm can perform any or all of the following:
- send SMS messages
- send e-mails (if e-mail option installed)
- activate and deactivate controls.

Each alarm can be programmed with a name, trigger source, 3 separate SMS telephone numbers, 2 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.

SMS sending

If SMS sending is enabled, an SMS with the programmed text is sent to each telephone number starting with the first. If sending is successful, the unit waits for 30(*) minutes for the user to acknowledge the alarm sequence. Acknowledging the sequence stops the sending of SMS messages.

If sending is not successful, due to network congestion for example, the SMS is sent to the same number after 1 minute. Up to three attempts are made to each number before proceeding to the next number.

After the 3rd attempt to the 3rd number (if applicable) the unit will stop sending SMS and wait indefinitely for the alarm to be reset. This limits the number of SMS transmissions per alarm to 9.

(*) 30 minutes is the default value. Users can change this to a period between 0 and 60 minutes.

E-mail sending (if e-mail option installed)

If e-mail sending is enabled, an e-mail with the programmed text is sent simultaneously to up to two addresses. If sending is successful, no more e-mails are sent.
If sending is not successful, up to 2 more attempts are made at 3 minute intervals.

Control activation and deactivation

Alarms can also be used for intelligent control of various systems. So for example, a tank level can be maintained by monitoring a water level and by controlling a pump. One alarm is set to trigger when the water level falls below a low level. This alarm is programmed 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 programmed 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 three different ways:
1. By accessing the "Alarms" page with a browser and clicking on the active alarm
2. By sending an SMS message to the Spider
3. By using the "Auto Acknowledge" feature

(Please see "Acknowledging 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, Spider AMR will wait for the trigger source to first go inactive.

Logger

Spider AMR incorporates a 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.

Spider AMR 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 (if e-mail option installed)
8. 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.

Analogue input, counter input and system monitor logging is enabled by the user.

These inputs are logged using the "SIGNIFICANT CHANGE" logging 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 from the last logged value. (If you want to log the data every hour, simply set the minimum change to 0.)

The logging period is shared by all analogue inputs, counter inputs and system monitors, while each input has its own programmable minimum change setting.

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.

Utility meter inputs are logged every logging period, regardless of by how much they change.

Please refer to Appendix A for a summary of input types.

Automatic reports (if installed)

A Spider AMR can be set up to send periodic reports via e-mail and/or FTP.

E-mail reports are sent to up to three recipients.
FTP reports are sent to a user-specified FTP server.

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

The advantage of automatic reports is in the Spider AMR ability to automatically deliver logged data without any user intervention.

An automatic report containing all data logged in the current day can be requested at any time by sending the 'GET REP' SMS command to the Spider.

Web Server

A sophisticated web server is built into every Spider AMR.

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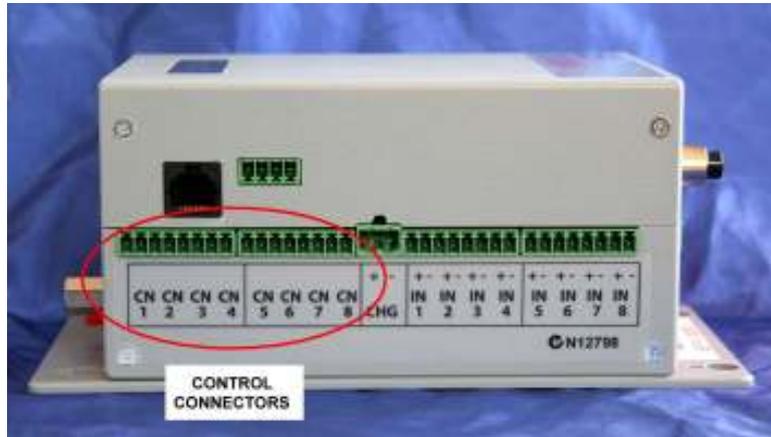
The web server is used for:

1. Setting up a Spider 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

All operations are performed by accessing simple web pages.

Physical Connections

Antenna

Each Spider AMR is supplied with a panel-mount "whip" antenna suitable for most applications. Directional antennas with higher gains are available for fringe areas.

Attach the antenna to the antenna connector located on the top of the Spider AMR case. **Hand tighten only.** Using tools to tighten antenna connectors may damage them, voiding the warranty.

Power

Spider AMR does not have an ON / OFF switch. The unit starts operating as soon as power is applied.

The unit is fitted with two power connectors:
- Battery – for connection of an external (rechargeable) battery
- Charger – for connection of an external solar or mains charger

Every Spider AMR incorporates a battery management system supporting 12V sealed lead acid batteries with capacities up to 10 Ah.
It provides all facilities required for a sophisticated power system, while requiring a minimum number of external components. Simply connect a battery to the battery connector and a solar panel or a mains charger into the charger connector. No external regulator is necessary.

Mains powered chargers must be able to provide a DC voltage between 15 and 24V at a minimum 1 A.

A range of solar panels, mains chargers and batteries is available from Halytech and its agents.

Please observe the correct polarity when connecting batteries and chargers to the Spider AMR.

PLEASE NOTE:
If you are using batteries of larger capacities and/or are using your own charging system, do not use the charger connector. Plug the battery into the battery connector and leave the charger connector blank.

In this way, you will still be able to monitor the battery voltage, log it, alarm on it etc.

Controls

Controls are connected to terminals marked CN1 to CN8.

Each control provides normally open relay contacts rated to 30V, 1A resistive loads. External **protection diodes must be installed** when driving inductive loads such as power relays.
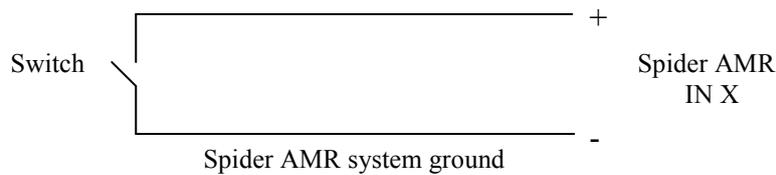
Inputs

Native Inputs

Native inputs are connected to terminals marked INPUT1 to INPUT8. Wiring depends on the type of input selected.
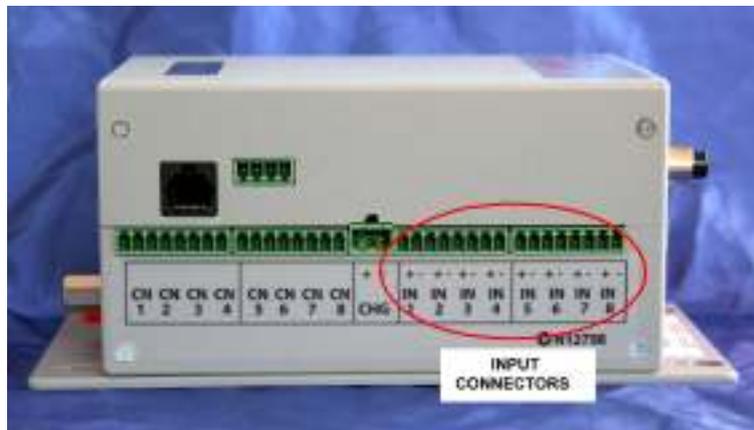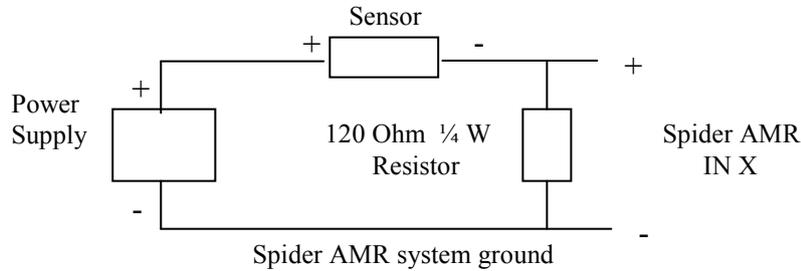

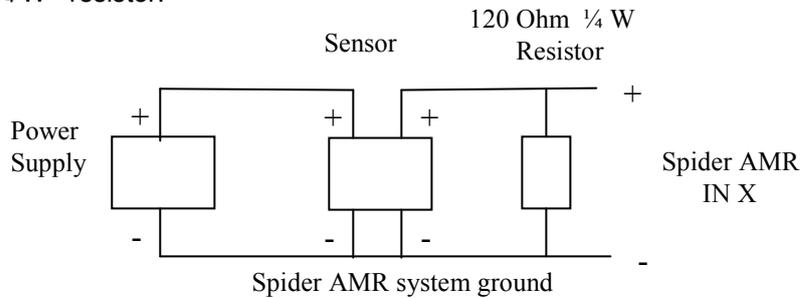1. "SWITCH", "COUNTER" and "UTILITY METER" types:

2. "ANALOGUE" type accepts an analogue voltage from 0 – 2.5V. The following diagrams show wiring details for most common sensor types.

(i) **2-WIRE 0 - 20 mA and 4 – 20 mA** current loop sensors require an external 120 Ohm, ¼ W   resistor (supplied):

(ii) **4-WIRE 0 - 20 mA and 4 – 20 mA** current loop sensors require an external 120 Ohm, ¼ W   resistor:

(ii) **Voltage inputs** may require up to two external resistors:
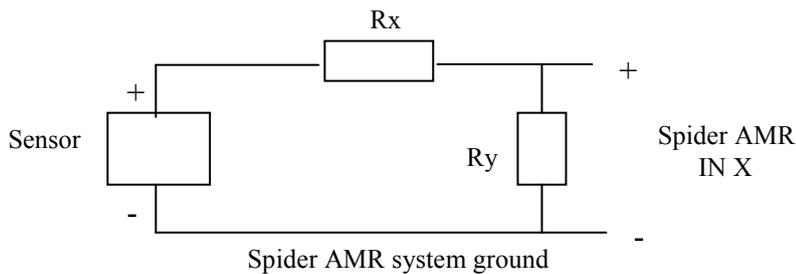
SENSOR RANGE	VALUE OF Rx	VALUE OF Ry
0 – 2.5V	None required	Leave out
0 – 5V	1 Kohm ¼ W metal film	1 Kohm ¼ W metal film
0 – 10V	3.3 Kohm ¼ W metal film	1 Kohm ¼ W metal film

NOTE: You may be able to use the AUX 1 connector to supply the power to your analogue sensor. Please refer to the next section titled "Auxiliary connectors" for more information.

Wireless Inputs

Wireless Receiver:

The Wireless Receiver is a separate electronics module. It connects to the Spider AMR AUX2 connector via a single cable. A typical connection is illustrated below:

Wireless Transmitter:

The transmitter wiring depends on the type of transmitter and the type of input. Please refer to documentation supplied with the transmitter for wiring diagrams, or contact Halytech.

For use with utility metering you may also need to install a pulse probe or a pickup into the meter if it is not already fitted. These are available from meter manufacturers or from Halytech.

Every wireless transmitter has a unique address. In most cases this address is 15 digits long with dashes as shown below, but some transmitters have a 12 character hexadecimal address. The address is located on a sticker attached to the transmitter. Record the address of each transmitter – it will be needed later in the setup.

EXAMPLE: Address of the device shown above is 00278-04-03153276. The 012 checksum will be displayed by the Spider to confirm the address is entered correctly.

Auxiliary Connectors
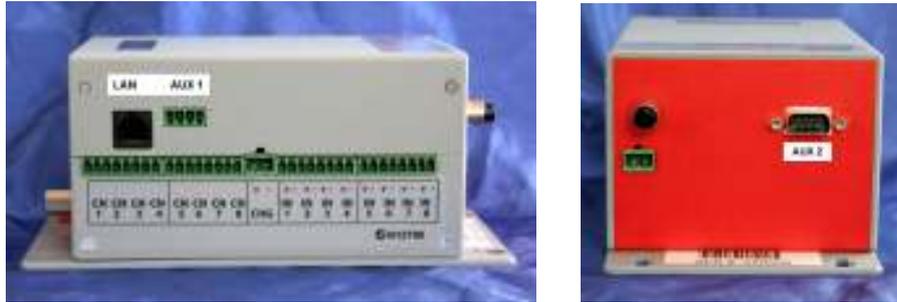
SPIDER AMR AUXILIARY CONNECTORS

Local Area Network (LAN) connector is used for connections to a PC, to a LAN or to a Wireless LAN.

AUX1 connector can be used to power analogue sensors. The leftmost pin (the pin closest to the LAN connector) provides a switched source of power. Power is automatically switched off when the Spider AMR enters the "sleep state", thus greatly reducing system power consumption. A warm-up period of approximately 4 seconds is provided when the unit re-enters active state.

NOTE: Voltage provided by the power pin on the auxiliary connector will be **the larger of the battery voltage and the charger voltage**. The pin is able to source up to 500mA of current.

An example of how to connect a two-wire 4-20 mA sensor to the Spider using the switched power pin on the AUX1 connector is shown below:
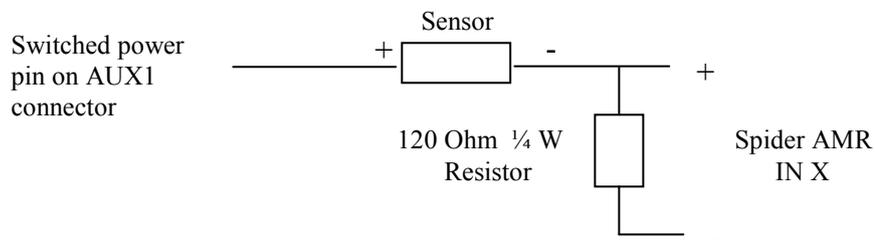
AUX2 connector is used for connection to wireless sensors as described earlier.

Setting up a Spider AMR for the first time

Depending on the model, a new Spider AMR must be connected to either a GSM or a NextG mobile telephone network. Please refer to Appendix G for details.

Before proceeding, make sure that both the Spider AMR and your computer are set up with correct, matching network parameters. Please refer to Appendix C and Appendix D for details.

A new Spider AMR is shipped from the factory with a default, generic setup. You may wish to change this setup and customise the Spider for your application.

Setting up a Spider AMR 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. Setting up and calibrating Wireless Inputs
6. Calibrating or scaling native Analogue, Counter and Event Inputs (if present)
7. Setting Control names
8. Setting up Alarms
9. Setting up Network parameters
10. Setting up E-mail parameters (if e-mail option installed)

Connect to the Spider as described in Appendix B.

The ALARMS page will be displayed.

Clicking "VIEW SETUP" in the blue menu pane on the left will display the following page:
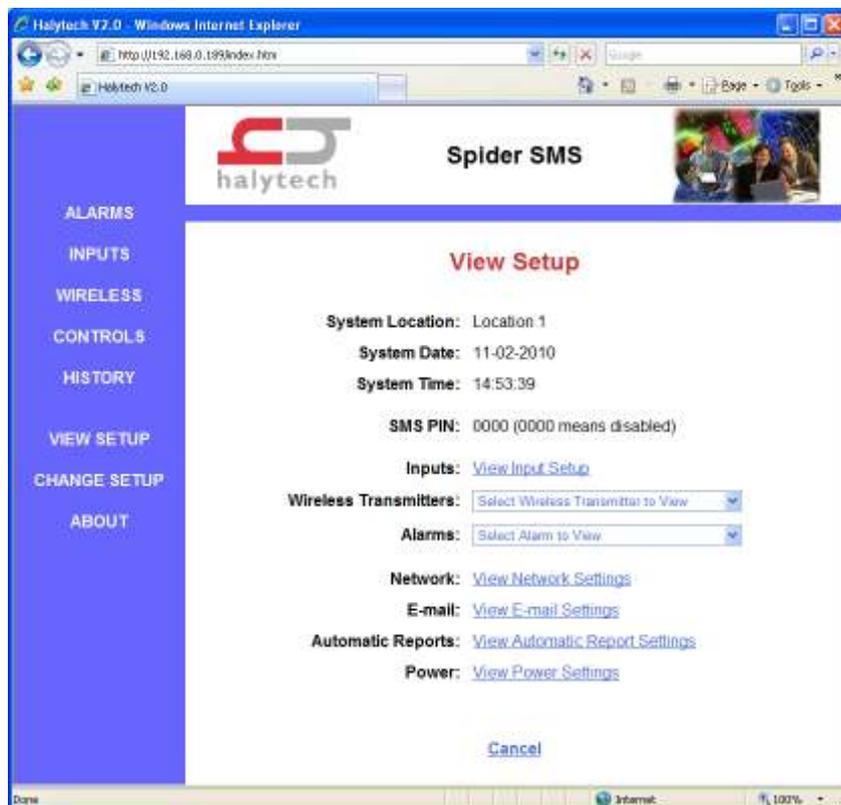
This page allows inspection of all Spider AMR programmable parameters, without making any changes.
(Depending on the installed options, your page may look different from the one above.)

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:

(Depending on the installed options, your page may look different from the one above.)

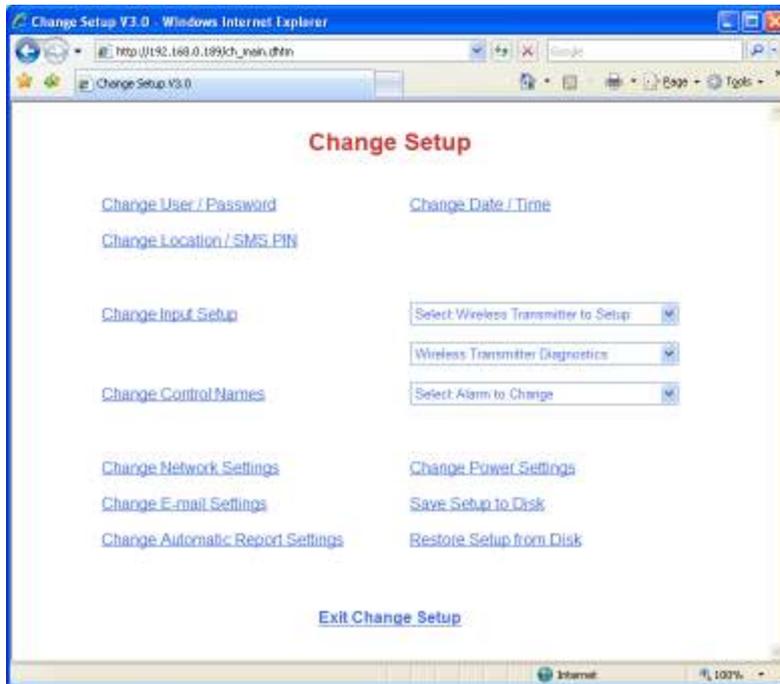NOTE: As indicated by the confirmation message, accessing the "Change Settings" page automatically disables logging, alarm generation and resets all active alarms. You can ignore the message here as we are setting up the device for the first time.

Setting Location

It is important to choose a unique location name for each Spider AMR. The location name is sent at the beginning of each SMS and e-mail transmission to identify the particular Spider device.

If not already displayed, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" above.

Click "Change Location / SMS PIN".
Enter a unique location name for this particular Spider. The name can be up to 16 characters long. For this example, let's use "Mudgee STP" as the name. Simply type this into the space provided.
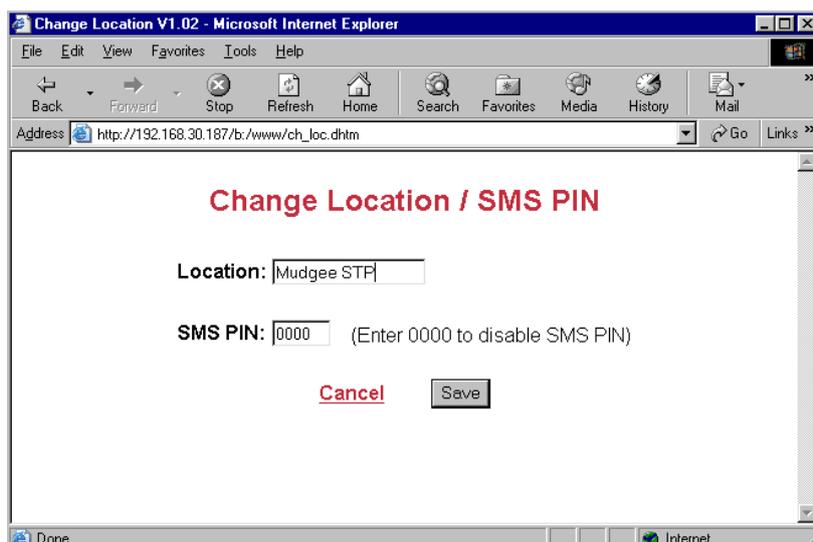
You can exit at any time without making changes by clicking the "Cancel" link.
Save the new value by clicking on the "Save" button.

(This page is also used for entering the PIN for SMS control activate/deactivate commands. Please refer to "SMS Commands" later in this manual for details.)

Setting Date and Time

If not already displayed, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time".

Click "Change Date/Time".
Confirm that the displayed date and time are correct. If you wish to change the date and/or time simply enter the new values.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

Setting User and Password

Only authorised users may access a Spider AMR. To connect to a Spider you must enter a valid username and password. Failing to enter them, disables all access to the Spider. Similarly, if a valid sequence is entered, but no activity takes place for 10 minutes, the access is revoked and the user must again log in.

The Spider supports two levels of access. Administrators have unrestricted access, while "normal" users can interrogate the device but cannot make any changes.

Usernames and passwords are programmable. Factory defaults for an administrator are "user" and "changeme" respectively, while for the normal user they are "user" and "user". It is strongly advised that these be changed as soon as possible to prevent unauthorised access.

If you forget your new username or password, you will no longer be able to connect to a Spider AMR. Please contact Halytech or its agent for assistance.

To change the usernames and/or passwords access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Click "Change User / Password".
Enter the new names and passwords.

You can exit at any time without making changes by clicking the "Cancel" link.
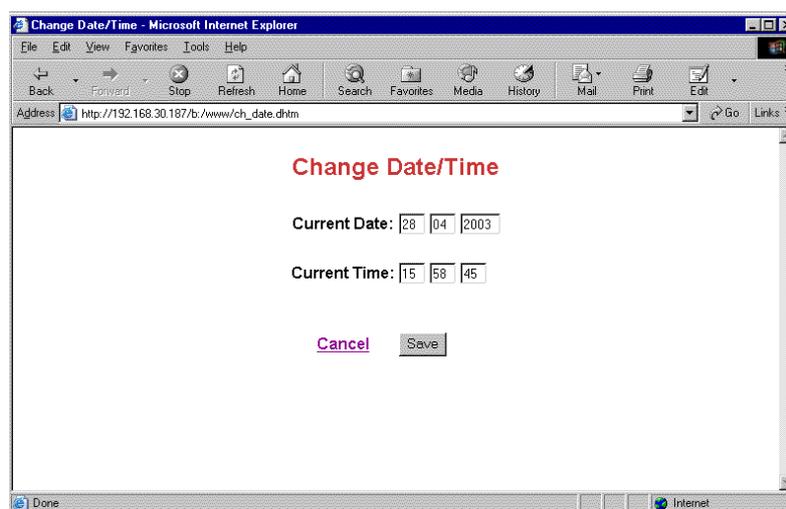Save the new values by clicking on the "Save" button.

Configuring Inputs

Decide how your inputs will connect to the Spider.

As described earlier in "Inputs", Spider AMR supports native and wireless inputs.

Native inputs can be configured in one of the following five modes: switch closure (digital), analogue, counter, utility meter and disabled.

Switch, counter and utility meter inputs accept simple ON/OFF sensors.
Analogue inputs accept a variety of transducers such as temperature sensors, water level sensors etc.

For example, you may want to monitor a total of only 5 Inputs – 2 native inputs and 3 wireless inputs.

The first native input will be switch (digital) type, monitoring operating status of a pump. The second will be an analogue input monitoring a tank level. Let's assume that "Pump status" will connect to Input 1 and "Tank level" to Input 2. The remaining 6 native inputs will be disabled.

Let's assume that the three wireless inputs are coming from two wireless transmitter modules, a single type and a dual type.

If not already displayed, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Click "Change Input Setup".

Select number of wireless modules as 2. The wireless inputs will be set up later.

If you have two or more Spiders within radio range of each other, they should be set to different RF zones. If you only have one Spider, leave it set to "Zone A".

Select "Switch" Input Type for the first input and "Analog" for the second one. Select "Disabled" for the remaining six native inputs.
Enter "Pump status" as the Input 1 Name and "Tank level" as the Input 2 Name.
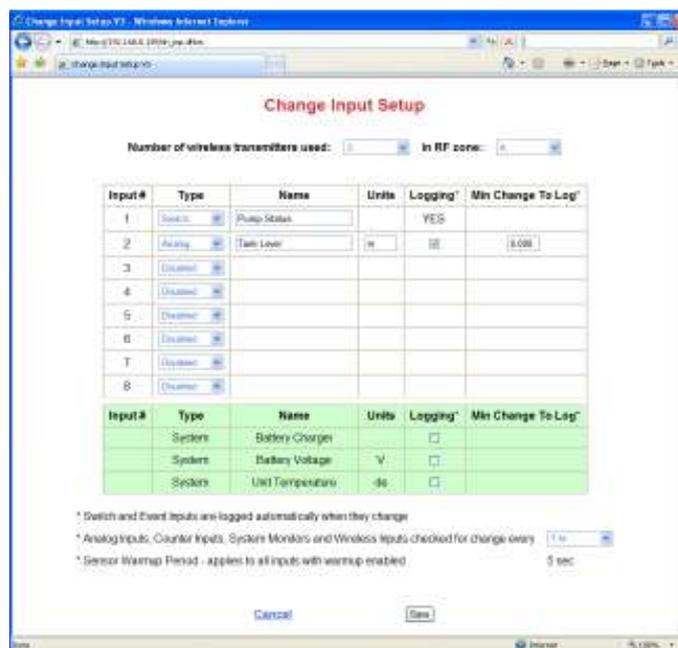
Switch (digital) inputs are logged automatically when their state changes. A switch input must be stable for a minimum of 5 seconds for a new state to be recognised.

Analogue and counter inputs, allow you to set their measurement units, whether you wish to log them and if so, the minimum change required to be logged.
The minimum change for each input works in conjunction with the "Scan period" which is common to all inputs and is also settable from this page.

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

In the example above, "Tank Level" is measured in millimetres ("mm"). It is checked for change every 30 minutes and logged if it changes by more than 50 mm. (If you want to log the level every 30 minutes regardless of by how much it changes, simply set the minimum change to 0.)

The same page also determines the logging of the 3 System Monitors. These are 3 additional system inputs which monitor the battery charger status, battery voltage and system temperature. System monitors logging is configured in a similar manner as described above.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

Calibrating Analogue Inputs (if present)

Analogue inputs should be calibrated prior to being used.
The system offers a choice of calibration methods:
1.   2-point calibration
2.   Manual calibration

2-point calibration

Let's continue with the previous example and calibrate a 4-20 mA water level transducer with a 0 – 1000 mm range connected to Input 3. We will firstly use the "2-point" calibration method.

If not already displayed, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" earlier in this section. Select "Calibrate Tank level" from "Select Native Input to Calibrate or Scale". A page giving calibration choices will be displayed. Select "2-point calibration" and click on "Proceed".

 The following page will be displayed:
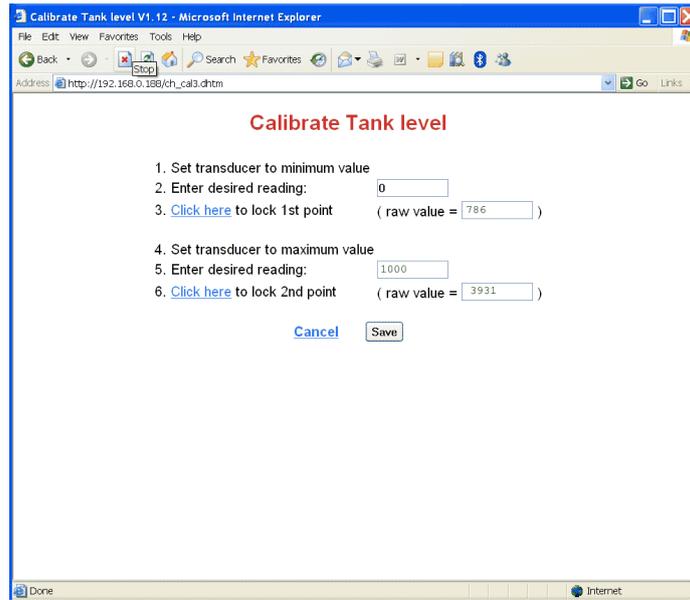
Follow the instructions step by step.

NOTE: The two calibration points can be any two values within the transducer range. However, they must be at least a half of the transducer range apart.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

Manual calibration

User inputs are calculated with the following formula:

Calibrated value = Scaler x (Raw Value) + Offset

Manual calibration allows direct entry of the "Scaler" and "Offset" quantities.
(The same formula is used in the 2-point calibration. The 2-point calibration procedure automatically calculates the "Scaler" and the "Offset".

Calibrating Counter and Utility Inputs (if present)

You can calibrate Counter and Utility Inputs in two ways:

1. You can scale them and
2. You can pre-set the counter to a particular reading

Scaling is useful to make the counters read engineering values. For example, your water meter may be producing one pulse per 5 litres of water flow. Hence, to make the counter register in litres, you would set the scaler to 5.

NOTE: Regardless of the scaler, counters will "wrap around" after a count of 999,999.999

It is sometimes required to pre-set the counter to a particular value. For example, you may wish to connect a water meter to a Spider and want to make the Spider's starting point the same as the reading on the meter.
To do that, simply enter the required reading in the "Offset" field.

Wireless Input Setup

Each wireless transmitter module needs to be configured separately. Continuing with the previous example, if not already displayed, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" earlier in this manual.

Click on "Select Wireless Transmitter to Setup" menu. (If you don't see this option, check that you have selected the required number of modules in the top section of the "Change Input Setup" screen.)

Once you have selected the module number you wish to configure the following screen will be displayed.

1. Enter a short description of the transmitter's location. E.g. "North Water Main"
2. Select the type of wireless transmitter you wish to use, eg "Waveflow - Single Channel". See the Overview for details on transmitter types.
3. WaveFlow transmitters have additional options that can be selected:
   Tick "Tamper Connected" if you have connected the tamper wires.
   Tick "External Calibration" if an external calibrator was used – See "Calibrating Wireless Inputs"
4. Enter the address of the transmitter that was recorded earlier in the section Physical Connections -> Inputs -> Wireless Transmitter. The Spider will display a checksum for you to compare with the one printed on the transmitter.
5. (Optional) If repeaters are in use select how many are needed and enter their addresses.
6. For each meter connected to the wireless transmitter, select its type - either "Wireless Counter", "Wireless Utility", "Wireless Analog" or "Disabled", and enter a name for the channel. You can also optionally enter a unit and Alternate ID. These will be used for display and filtered reports. e.g. "Fire Service" and "kl"

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save Setup and Calibrate Module" button. You will be taken to the calibration screen.

Calibrating Wireless Inputs

Calibration of wireless inputs is very important as the procedure initialises the module. In contrast to native inputs which are each calibrated separately, all inputs connected to a particular wireless transmitter module are calibrated together.

If the calibration screen is not already displayed, access "Select Wireless Module to Setup" and click "Save Setup and Calibrate Module". The computer will display "Please wait for a new sensor reading ..." for about 5 seconds and then the calibration screen will load (it will take longer if repeaters are in use).

Please refer to Appendix J if an error message is received.
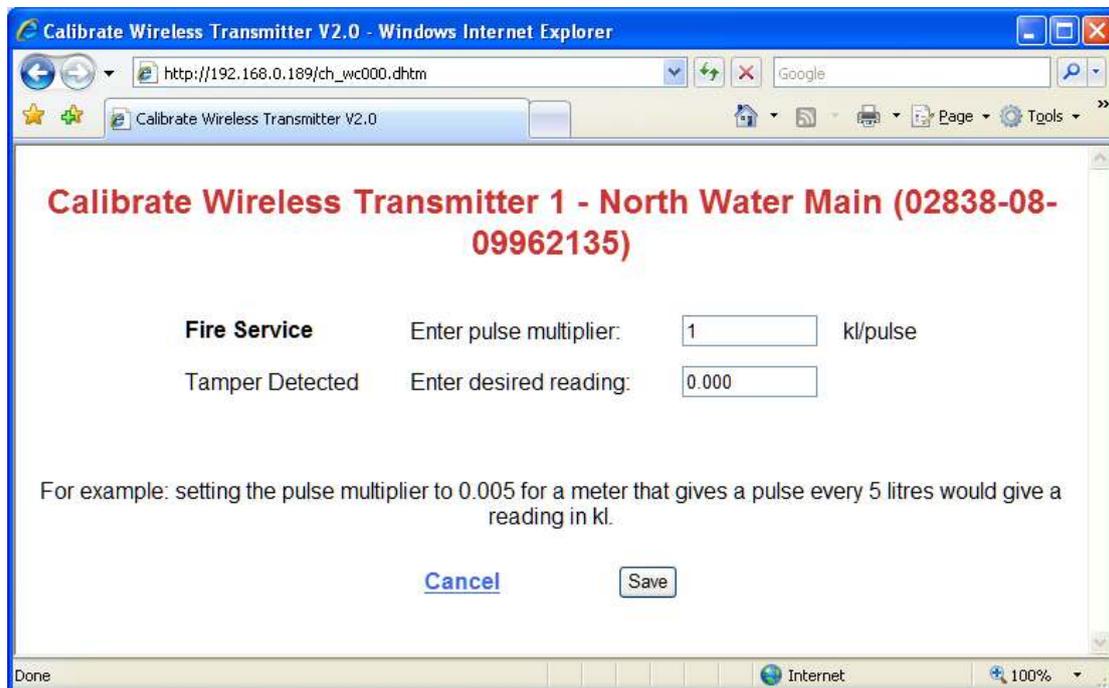
Two calibration parameters are available for every input connected to the current transmitter.
- For WaveFlow transmitters they are: the multiplier (scaler) and the desired current reading.
  - The multiplier sets the relationship between meter pulses and engineering units. For example – you require a reading in kilolitres from a meter which gives a pulse every 5 litres. The multiplier is then 0.005 kl per pulse.
  - You may also wish to synchronise the Spider display with the "real meter" display. To do that, simply enter the current "real meter" reading.

- For WaveSense and WaveTherm they are multiplier and offset.
  - The logged reading = input (in mA, V or °C) x multiplier + offset

For WaveFlow transmitters it is possible to calibrate the reading by using an external device such as the Halytech Signal Checker. In this case the screen that appears will show the values that were retrieved from the transmitter and will not allow changes.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

Setting Controls

Decide how your controls will connect to the Spider.

For example, you may want to control only 2 outputs.
 (Spider AMR Controls need not be used sequentially. Unused controls may be interspersed with used controls.)

Let's assume that "AUX PWR ON" will connect to Control 1. It will be activated manually either via the browser or by sending an SMS command to the Spider.

"SPRINKLER" will connect to Control 2. It will turn on the sprinkler when a sensor determines the ground is too dry. We will use an alarm for this.

If not already displayed, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Click "Change Control Names". The only settings required at this stage are the new names for the controls.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

Setting up Alarms

Decide how many alarms will be used. Each alarm has a programmable name, trigger source, SMS text, 3 telephone numbers and the ability to activate or deactivate a control.

E-mail option adds 2 e-mail addresses to the alarm configuration.

For example, let's set up Alarm 1 as follows (assumes e-mail option is installed):

Alarm Name:	Pump fail
Trigger Source:	Pump status
Trigger Level:	"ON" i.e. trigger when source is "ON" or active
Control Action:	Control 1 ON - continuous
SMS / E-mail Text:	Pump 1 has failed
SMS Sending:	enabled
1st SMS Phone #:	0414111111
2nd SMS Phone #:	0414222222
3rd SMS Phone #:	0414333333
E-mail sending:	enabled
1st Email Address:	me@somewhere.com

If not already displayed, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Select "Change Alarm 1" from "Select Alarm to Change".
Fill in the form with the details above.
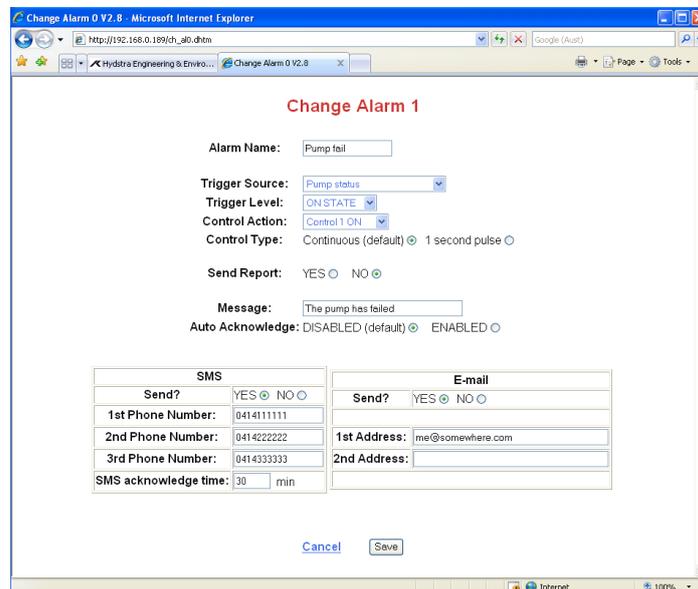
The "SMS acknowledge time" is the period of time (in minutes) during which an alarm must be acknowledged and to stop the Spider from sending SMS to the next number on the list. It can be set to 0 to 60 minutes.

You can exit at any time without making changes by clicking the "Cancel" link.
Save the new values by clicking on the "Save" button.

NOTES:

1. Trigger source is selected from the drop-down list. The list will display all available inputs identified with their user-programmed names. All unused alarms should be disabled by selecting "DISABLED" from the list.

2. If there is at least one wireless input enabled in your Spider, there will be two additional alarm triggers: wireless low battery and wireless tamper. Wireless battery will be active if the internal battery in **any** enabled wireless transmitter module is nearing the end of its life. Similarly, wireless tamper will trigger if tamper (wire-cut) has been detected on **any** enabled wireless transmitter module.

3. If a wireless input is used as the trigger source then alarm can only trigger when the Spider polls the transmitter, which in order to conserve transmitter battery is much less than the logging period.
   If this is a problem for your application, please contact Halytech. A workaround is available at the cost of increased transmitter battery consumption.

4. Control action may be specified as continuous or pulsed. For example, the setting "Control 1 ON" in the continuous mode will turn Control 1 on and leave it on. The pulsed mode will turn Control 1 on for approximately 1 second and then turn it off.

5. Enabling "Auto Acknowledge" will automatically acknowledge an active alarm after a user settable amount of time. (In other words, a user need not acknowledge the alarm manually by sending an SMS or by using a browser.)
   NOTE: Even with "Auto Acknowledge" enabled, the alarm will not start sending a new series of messages unless the alarm goes inactive as well.

6. When entering phone numbers, enter **digits only** i.e. do not use spaces, brackets or hyphens.

7. If you don't need all 3 telephone numbers or both e-mail addresses, simply leave the appropriate fields blank.

8. Available trigger conditions will change depending on the type of input used to trigger the alarm.
   For example, switch (or digital) inputs can trigger on the "ON STATE" or the "OFF STATE", while analogue inputs will allow triggering on "ABOVE", "BELOW" or a rate of change.
   Please refer to Appendix A for details on input types and their triggering ability.

9. Alarms can initiate sending of Automatic reports (if installed). Please refer to Advanced Operation – Automatic Reports for more information.

Setting up Network Parameters

Spider AMR can connect to local area networks (LAN) and wide area networks (WAN).
LAN connections are primarily used for communications with local computers.
The Spider uses WAN connections to access the Internet in order to send e-mails and FTP reports.

LAN settings

Please refer to Appendix C for more information about initial connection of a Spider AMR to a Local Area Network (LAN).

To set up Network parameters, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Click on "Change Network Settings".

Fill in the form with details appropriate for your network.
You will need to obtain this information from your network administrator.

Easy Connect settings:
- Select "ENABLED" for stand-alone Spiders (Spiders not connected to a local area network (LAN)
- Select "DISABLED" for Spiders connected to a local area network (LAN)

NOTE: New settings will take effect after the device is powered down and then powered up.

WAN settings (if e-mail option installed)

WAN parameters need to be entered only if you wish to send e-mails or FTP reports.

Spider AMR can connect to the Internet using one the following three methods:
1. Local Area Network (LAN)
2. GPRS (for GSM and NextG models only)
3. Dial-up Internet

Select the desired WAN connection method. The page will change accordingly.

LAN:

You can use this option if the Spider is connected to a LAN which allows Internet access.

You will need to obtain the Gateway, Primary and Secondary DNS from your network administrator

GPRS:

Use this option for remote Spiders fitted with GSM and NextG modems. 3G networks such as NextG often use the term "HSDPA", which is a faster version of GPRS.

Access Point Name (APN) is provided by the mobile phone company which supplied your SIM card. At the time this manual was issued, the correct settings for common Australian networks were:

Telstra APN: telstra.internet
Optus APN: internet
Vodafone APN: vfinternet.au

IMPORTANT NOTE: Above settings are given in good faith. Halytech or its agents accept no responsibility for their accuracy.

Dial-up Internet:

Dial-up can be used to connect to an ordinary dial-up ISP if GPRS is not available. Halytech recommends that GPRS is used whenever possible as it faster and less expensive.
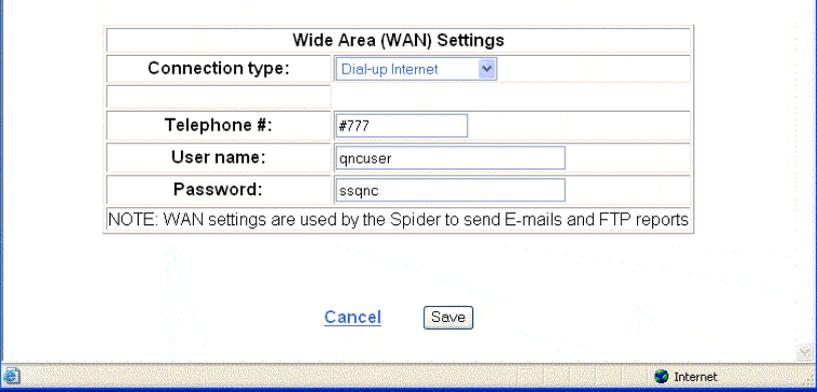
Telephone #, User name and Password are supplied by your Internet Service Provider (ISP).

IMPORTANT NOTE: Above settings are given in good faith. Halytech or its agents accept no responsibility for their accuracy.

Setting up E-mail Parameters (if e-mail option installed)

E-mail parameters need to be entered only if you wish to send e-mails.

To set up E-mail parameters, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this section.

Click on "Change E-mail settings".
Fill in the form with details appropriate for your network.
You will need to obtain this information from your network administrator or your mobile service provider.

At the time this manual was issued, the correct settings for common Australian mobile networks were:

    Telstra SMTP mail server: mail.bigpond.com
    Optus SMTP mail server: mail.optusnet.com.au
    Vodafone SMTP mail server: smtp.vodafone.net.au

My e-mail address: In the process of sending an e-mail, the Spider AMR must identify itself to the mail host computer with a valid e-mail address. Set this parameter to a known valid address, acceptable to your mail host. This address is shown in the e-mail as the "From" address.

NOTE: if the e-mail is accepted by the host but cannot be delivered, the failure notice will be sent to this address. (Perhaps if you set this to your own e-mail address, you can monitor e-mails that can't be delivered!!)

Test e-mail address: Test e-mails are sent to this address.
This is a special feature of the Spider AMR allowing a rapid and user friendly way of setting up and verifying Spider AMR e-mail connectivity. Please refer to Appendix H for details.

SMTP authentication:

Most SMTP servers do not need authentication and hence this field should be left "DISABLED".

If your server does require authentication, select "ENABLED" and enter a user name and a password. You can obtain these from your network administrator.

Network Glossary

The Network and E-mail sections used several networking terms. All of these are standard network parameters as used in IT. Detailed explanations are beyond the scope of this document. However, here is a brief explanation of each parameter noting any special relevance to the Spider AMR implementation:

My IP Address (*): current IP address of Spider AMR. This is the same as the value shown on the LCD display.

Network Mask (*): Network mask. This is the same as the value shown on the LCD display.

Gateway (*): IP address of a computer allowing access from the local network to the Internet.

Primary DNS (*): IP address of the primary domain name server. The server performs translation from domain names such as "halytech.com.au" to 'dotted ip' format such as "192.168.0.189".

Secondary DNS (*): IP address of the secondary domain name server. The server performs the same function as the Primary DNS. It is contacted only if there is no reply from the Primary DNS.

SMTP mail server: address of a computer serving as a mail host. Spider AMR will contact this computer to send the actual e-mail. The address may be given as a name e.g. "mail.somewhere.com.au" or as a 'dotted IP' address e.g. "203.16.222.34".

NOTE: You must power down and then power up the Spider before the new values marked with (*) take effect.

Save Settings to Disk

Once you have configured a Spider AMR for your application you can save all the settings on your computer. This is useful as a backup or if you have multiple Spiders and you wish to save a "template" that can be uploaded to other Spiders with very similar settings. Then, instead of entering all parameters from scratch you can simply edit the ones that need to be changed.

To save the settings simply click on the "Save Settings to Disk" link. The computer will prompt you whether to open or save the configuration. Choose "Save" and when prompted enter the name of a file which will hold your settings.

Load Settings from Disk

Once you have saved system settings as described above, you can upload them to any other Spider.

To load the settings click on the "Load Settings from Disk" link. The computer will prompt you to enter the name of a file containing the settings. Enter the name of the file or select a file anywhere on your computer by clicking on "Browse".

NOTE: Loading settings from disk will overwrite your current settings.

Exiting Change Settings Mode

Logging, alarm activation, timers and timer overrides are all disabled while in the change settings mode.

To exit change settings mode click "EXIT CHANGE SETTINGS" link on the bottom of "Change Settings" page.

This will immediately restart logging, alarm generation and all enabled timers.
NOTE: any timer overrides active prior to entering the "Change Settings" page are not re-instated on exit.

Setup change mode is automatically exited after 10 minutes of inactivity.

Normal Operation

Front Panel Display

Spider AMR is equipped with a two-line display and a one-key keypad. They are used for quick operational checks and basic setup. Their convenience lies in the fact that using them requires no external equipment such as laptop computers or mobile phones.

Normally, the display shows:

SPIDER AMR
Signal: G65%

"Signal: G65%" indicates the current cellular phone signal strength. The higher the number, the stronger the signal. As a rough rule-of-thumb, a value of 41% and above is acceptable. Signal strength is updated every 5 seconds. The letter preceding the percentage value indicates the type of mobile network used by the particular Spider AMR. A "G" represents the GSM network and a "N" represents a NextG network.

Value "??" or "—" indicates that there is no mobile phone coverage in the present location, there is no valid SIM card inserted (GSM models only) or that the cellular phone module inside the Spider is not responding. (Is the antenna plugged in?) It is a normal indication during power-up and immediately following remote access. It typically lasts less than 60 seconds.
If however, this display persists, contact Halytech or its agent.

An 'L' in the lower left corner indicates that the system is currently interrogating wireless transmitter modules. For a large number of modules this can take several minutes.

During a telephone call (remote access) the display shows:

SPIDER AMR
Remote Access

Different display screens are accessed by briefly pressing the keypad key. Each key press will display a new screen. Different screens are:

1. Current date and time
2. Current state of inputs
3. Current states of battery charger and battery voltage
4. Current value of system temperature
5. Current state of Alarms 1 – 4 (AL1 – AL4)
6. Current state of Alarms 5 – 8 (AL5 – AL8).
   Active alarms are indicated by "Axx" where xx is the current alarm status code –
   Please refer to section "SMS Alarms" for additional information on the status codes.
   Inactive alarms are indicated by an "I".
   Disabled alarms are indicated by a "D".
7. Current state of Controls 1 to 4 (CN1 – CN4). Active Controls are indicated by a "1" and inactive ones by a "0"
8. Current state of Controls 1 to 4 (CN1 – CN4). Active Controls are indicated by a "1" and inactive ones by a "0"
9. Current LAN IP address and IP Mask
10. Easy Connect Status - Enabled/Disabled as configured in "LAN Settings". If enabled it also shows either "Active" (normal operation) or "Stopped" if an external DHCP has been detected on the network.
11. Sending of test e-mail messages. (Refer to Appendix H for additional information)

Communicating with a PC

Spider AMR uses an intuitive, user-friendly, web-browser system. You can use any standard browser on any computer to communicate with the Spider. No special software is required.

Communicating with the Spider is identical to "Surfing the Internet". Information is displayed by clicking links and buttons.

You can connect to a Spider AMR either locally via a cable or remotely via a modem. Once connected, operation is identical regardless of connection. The only difference you may notice with a remote connection is a slightly slower response.

Connect to the Spider as described in Appendix B.
A successful log-on will automatically display the Alarms screen.

Alarms

Current alarm states are displayed automatically following a successful log-on. The same screen can be displayed at any time by clicking "ALARMS" on the blue menu pane on the left.

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

Active alarms provide additional information about the progress of the alarm sequence by displaying a numerical code. Please refer to section "SMS Alarms" for the key to the code.
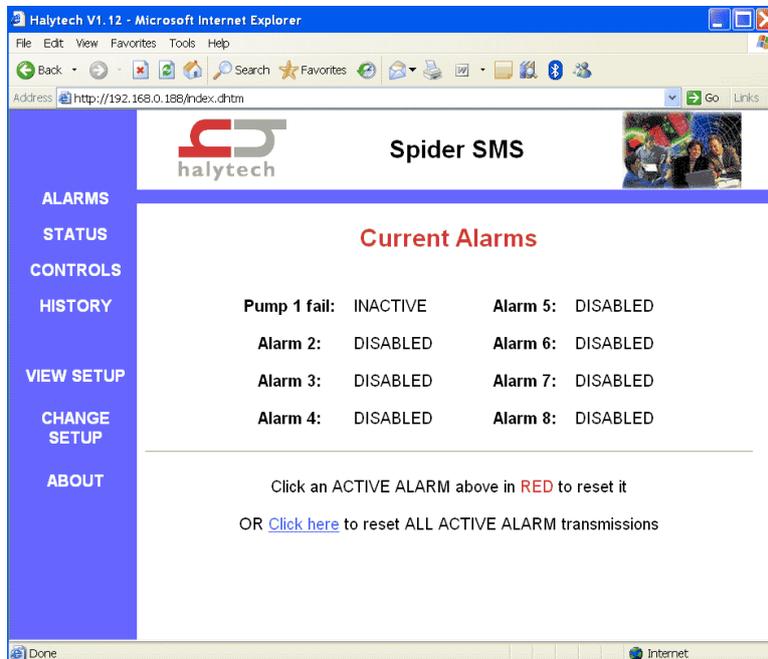
Acknowledging Alarms

Active alarms can be acknowledged individually by contacting the Spider and clicking the particular alarm.

ALL active alarms may be acknowledged at once by clicking on the link at the bottom of the main pane.
If there are no active 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.

Native Inputs

Current native input states are displayed by clicking "INPUTS" on the blue menu pane on the left. All Inputs signals are identified by their user-programmed names.

The display shows the state of all Inputs at the time the page was displayed. The page automatically updates every 10 seconds.
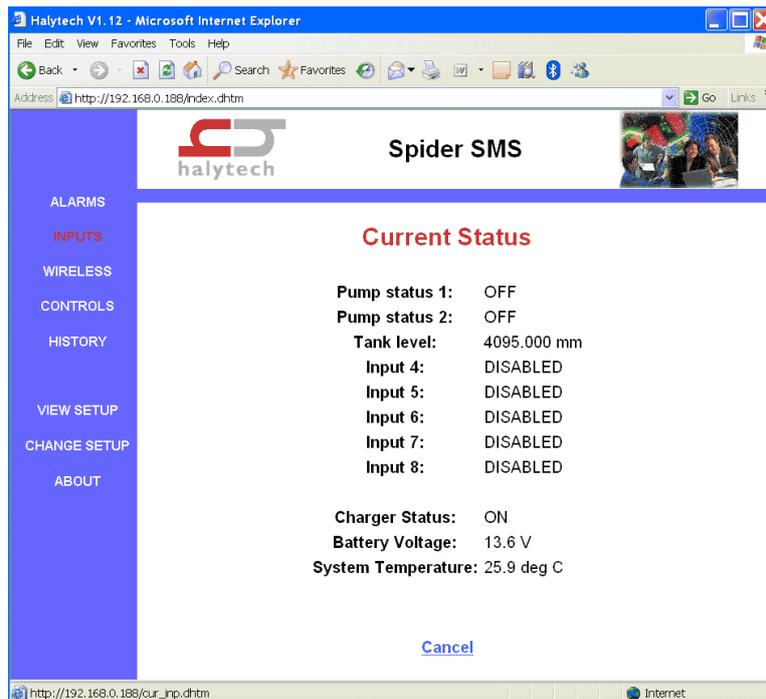
Wireless Inputs

Most recently available wireless input states are displayed by clicking "WIRELESS" on the blue menu pane on the left.

Use the menu at the top of the status page to select which wireless inputs you wish to view.

Next to each input's value are a set of letters (displayed in red) that indicate the status of the module:

*   NOT an error. Indicates that the reading is has not been updated since the Spider came out of sleep mode.
T   Indicates that the input's Tamper detection has been tripped.
B   Indicates that the module's internal battery is getting low.
?   Indicates that the last communication with the module failed.

In order to maximise the wireless transmitter battery life, wireless inputs are not automatically refreshed.

To manually refresh the wireless inputs click on the "Update Display" button. It may take several minutes for the Spider to poll all remote transmitter modules and update the wireless input readings. Clicking this button will also cause the Spider to reset the tamper status of the modules.

An alternative way of manually refreshing all wireless input readings is to use the Spider's built in display and keypad. Press the keypad switch repeatedly until the main screen with the signal strength is displayed. Pressing and holding the switch for approximately five seconds will activate a manual refresh.

Please refer to Appendix I if you experience communication problems with wireless inputs.

Controls

Current Controls and their associated Timer and Timer Override states are displayed by clicking "CONTROLS" on the blue menu pane on the left. All Controls are identified by their user-programmed names.
The display shows the state of all Controls at the time the page was displayed. You can change as many outputs at once as you wish by clicking "ON" or "OFF" selectors as required and then clicking the "Save" button. The page will be updated to reflect the new Control states.
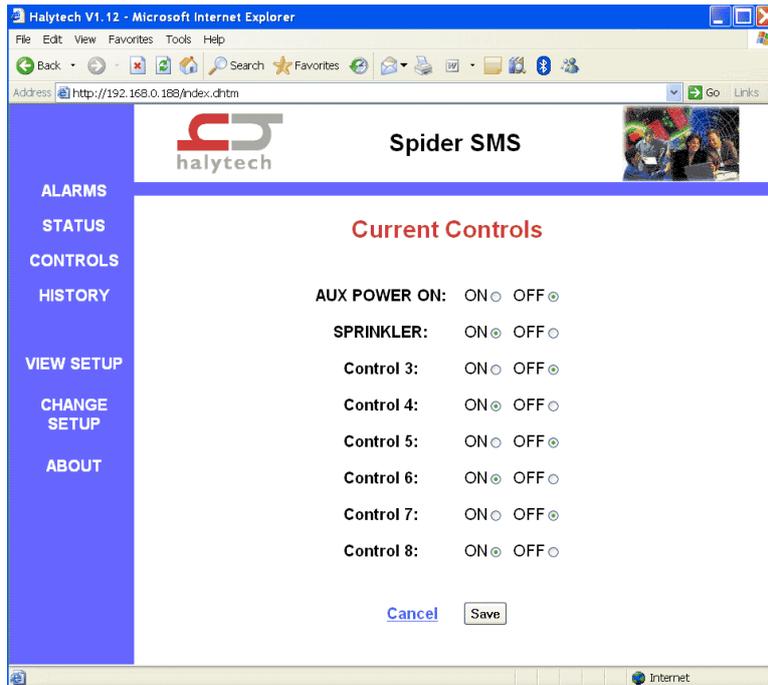
History

Spider AMR logs:

1. Input changes
2. Control changes
3. Alarm activations and resets
4. SMS transmissions and their outcomes
5. SMS command reception
6. E-mail transmissions and their outcomes (If e-mail option installed)
7. Daily report outcomes (If e-mail option installed)
8. System messages

Each log record consists of a date and time stamp to a resolution of 1 second, numeric record identifier 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. Next, specify the period of interest and the number of records to download by filling in the form.
Data is downloaded "backwards" in time. In other words, the most recent records are downloaded first. In order to minimise amount of data being transferred, you can specify the date and the time of the first record and the maximum number of records to download.

If the logging period is less than 1 hour and and wireless inputs are in use, the downloaded file may be missing up to an hour of wireless input data.
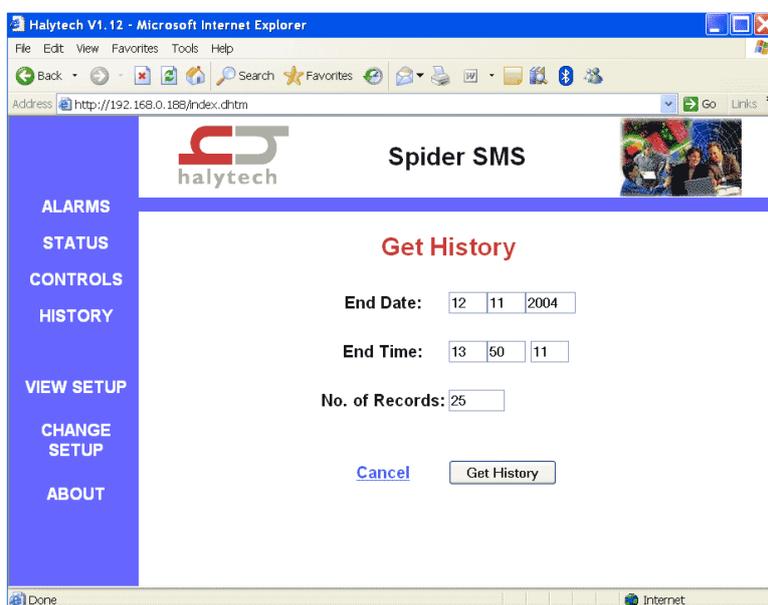
Click "Get History" button to start the download.
Data is downloaded as a "CSV" file. Download can automatically start Microsoft Excel program on your computer (if installed) to show, edit or store the data.

About

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

SMS Alarms

When an input triggers an alarm with SMS sending enabled, an alarm sequence will start. Current state of an active alarm is shown on the LCD display and the ALARMS page as a code. The code has the following meaning:

ALARM CODE	MEANING
RST	Alarm has been acknowledged, but the trigger source is still active. Trigger source must go inactive before another alarm sequence can be started.
1	Spider is attempting to send 1st SMS to 1st phone number.
2	Spider is attempting to send 2nd SMS to 1st phone number.
3	Spider is attempting to send 3rd SMS to 1st phone number.
4	Spider is attempting to send 1st SMS to 2nd phone number.
5	Spider is attempting to send 2nd SMS to 2nd phone number.
6	Spider is attempting to send 3rd SMS to 2nd phone number.
7	Spider is attempting to send 1st SMS to 3rd phone number.
8	Spider is attempting to send 2nd SMS to 3rd phone number.
9	Spider is attempting to send 3rd SMS to 3rd phone number.
10	Spider has made a maximum of 9 SMS send attempts without receiving a reset command. No more send attempts are being made.

Transmitted alarm SMS messages have the following format:

Location: SMS text (Send 'RST Alx' to reset)

Where:
"Location" is the programmed Spider AMR location
"SMS text" is the programmed SMS text for this particular alarm
"x" is this particular alarm number (1 – 8)

So, if we use the examples programmed in the section "Setting up a Spider AMR for the first time" the first alarm SMS will be sent to 0414111111 and will be:

Mudgee STP: Pump 1 has failed (Send 'RST AL1' to reset)

The alarm sequence may be reset simply by replying with the received message (no typing required !!), or by replying with **RST AL1** or by connecting to the Spider with a PC and resetting the alarm as described in "Resetting Alarms"

NOTE: Alarms will be registered while in the Remote Access mode, but SMS messages will not be sent until Remote Access mode terminates.

SMS Commands

Spider AMR can receive and respond to specially coded SMS commands. The commands may:
1. Get the current state of all status signals
2. Get the current state of all controls
3. Reset an active alarm
4. Reset all active alarms
5. Activate and deactivate controls - can be protected with a 4 digit PIN
6. Request Daily Report containing all of current day's data (if e-mail option installed)

The following SMS commands are recognised:

Command	Comment	Example
HELP	Request list of supported commands	HELP
GET ST	Get current state of all status signals	GET ST
GET SYS	Get current state of system monitors	GET SYS
GET CN	Get current state of all controls	GET CN
RST ALx	Reset Alarm x (x is 1 – 8)	RST AL6
RST ALL	Reset all active alarms	RST ALL
ON CNx	Activate control x (x is 1 – 8) (no PIN)	ON CN2
yyyy ON CNx	Activate control x (x is 1 – 8) (PIN =yyyy)	1234 ON CN2
OFF CNx	Deactivate control x (x is 1 – 8)	OFF CN4
yyyy OFF CNx	Deactivate control x (x is 1 – 8) (PIN =yyyy)	1234 OFF CN4
PULSE CNx	Pulse control x for 1 second (x is 1 – 8)	PULSE CN4
yyyy PULSE CNx	Pulse control x for 1 second (x is 1 – 8) (PIN =yyyy)	1234 PULSE CN4
GET REP	Request Daily Report (available only if e-mail option installed)	GET REP

After a Spider AMR 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 Spider AMR location
"SMS command" is the SMS command

So once more using the programmed example, the acknowledgement SMS will be:

Mudgee STP: OK RST AL1

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 Spider AMR either remotely or locally with a computer and entering the PIN as described in "Setting up a Spider AMR for the first time", "Setting Location" earlier in this manual.

NOTES:
1. Commands may be in lower or upper case or a combination of both
2. There must be only one space between the words of a command
3. SMS commands will be ignored while in the Remote Access mode. Therefore if an SMS command is not acknowledged by a return SMS within approximately 1 minute, send the command again after a short period of time.

Advanced Operation

Automatic Reports (if installed)

Spider AMR can be set up to automatically send reports. A report can be sent by e-mail and/or by File Transfer Protocol (FTP).

There are 3 types of automatic reports, all operating independently of each other:

- Daily reports
- Periodic reports
- Ad-hoc reports

Daily reports are sent once per day, at a user selectable start time. They contain all data collected in the previous 24 hour period. So, for example, if the user sets the Daily report start time to 4:00, the report will contain the data between 4:00 AM the previous day to 03:59 AM on the current day.

Periodic reports can be sent every hour, every 3 hours, every 6 hours or every 12 hours, as selected by the user. They are always "lined-up" with real time. So, 6-hourly periodic reports will be sent at 06:00, 12:00, 18:00 and midnight. Each report contains the data collected in the previous reporting period.

Ad-hoc reports are initiated by a user SMS command or by an active alarm with "send Report" setting set to YES.
Ad-hoc reports initiated by alarms contain data collected in the current day.
User can request an ad-hoc report containing data for a single day up to 7 days in the past.

For example, sending the command "GET REP" will request a report with the current day's data. A command "GET REP3" will request all data collected in the single day, 3 days ago. (NOTE: there is no space before the digit '3')

Each e-mail report has a spreadsheet file attached to it. The file contains all data logged over the applicable period. Reports can be sent to up to three different recipients. Up to three attempts will be made to send an e-mail report. All attempts are logged.

An FTP report automatically delivers the logged data file to an FTP server. Up to three attempts will be made to send an FTP report. All attempts are logged.

Report files are available in two formats: raw and filtered.

Raw format is identical to the Spider logged file format described in Appendix E. It contains all logged data including system information such as reception of SMS messages, outcome of alarms, reports etc.

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

You can also choose the time order in which data is given. Data may be presented in ascending or descending time order.

The Spider makes up to three attempts to send each report – maximising the transmission success rate even under difficult communications conditions.

Daily reports are provided with "Daily report recovery". This feature is especially useful for automated data collection systems. If a daily report transmission fails three times as described above, the next day's report will contain the data for that day and the previous day.

This process is repeated for up to 7 days in the past. The maximum size of such a multi-day report is 24,000 records.

To configure daily reports, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this document. Click "Change Daily Report Settings".

NOTES:

1. Automatic report function requires that both Network and E-mail option be configured correctly. Please refer to "Setting Up Network Parameters" and "Setting Up E-mail Parameters" earlier in this document for additional instructions.

2. Automatic report files are named as follows:

    a. Daily report:
        (first 8 chars of Location)_(date).csv
        Example: Location_291205.csv

    b. Periodic report:
        (first 8 chars of Location)_(date)_(time of first transmission attempt)P.csv
        Example: Location_291205_1105P.csv

    c. Ad-hoc report (for current day):
        (first 8 chars of Location)_(date)_(time of first transmission attempt).csv
        Example: Location_291205_1105.csv

    d. Ad-hoc report (for x days ago), where x is between 1 and 7:
        (first 8 chars of Location)_(date x days ago)_2359.csv
        Example: Location_271205_2359.csv

    Blanks in the Location part of the filename will be replaced by '-' characters

Spider AMR Power Options

Spider AMR is designed specifically for low power, battery operated applications. The standard battery complemented with a solar panel can provide sufficient power for many months of unattended operation.

Two user selectable options provide advanced power management for special applications.

IMPORTANT NOTE:
Advanced power settings should only be changed by experienced users. Selecting the "wrong" option can result in inability to remotely connect to a Spider AMR, in drastically reduced battery life or even a complete battery failure.

Always-on Operation

Spider AMR is normally in the "sleep" state. This state is indicated by a blank LCD display. The system automatically "wakes-up" as required to scan analogue inputs, log, receive & send SMS, e-mails etc. It remains "awake" for the shortest possible time and the goes back to "sleep".

The main advantage of the LP (Low Power) mode is greatly reduced power consumption and increased battery life. The LP mode is the default mode, recommended for most applications.

The disadvantages of the LP mode are:
1. Ethernet (Local Area Network- LAN) port is not available during "sleep"
2. Analogue channels are not scanned during "sleep"

It is possible to keep the system continuously "awake" by selecting the "Always-on" power mode.

NOTE: Always-on mode should only be selected for mains-powered applications when continuous LAN access or faster analogue input scanning is desired. At all other times the default LP mode should be used.

To change the operating mode, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this document. Click "Change Power Settings".

In "System Power:" select "LOW POWER (default)" or "ALWAYS ON" as desired.

Extra Low Power Operation – Modem Scheduling

Spider AMR power consumption may be drastically reduced by scheduling the times during the day when the internal modem is powered up. The modem consumes approximately 90% of the power while the unit is in its normal mode i.e. when the display is blank.

This dramatic improvement in power consumption comes at the cost of the ability to remotely connect to the Spider AMR. Modem scheduling lets you customise your application by finding an optimal combination of remote access times and power consumption.

NOTE: During the scheduled modem OFF times, only the remote access is unavailable. Alarm initiated SMS and e-mail transmissions will operate normally.

Modem scheduling is disabled by default, i.e. the modem is always turned on.

To enable modem scheduling, access the "Change Settings" page as described in "Setting up a Spider AMR for the first time" earlier in this document. Click "Change Power Settings". The following page is displayed. (If the "Daily Power Schedule" is not shown, click on "CONTROLLED BY SCHEDULE").
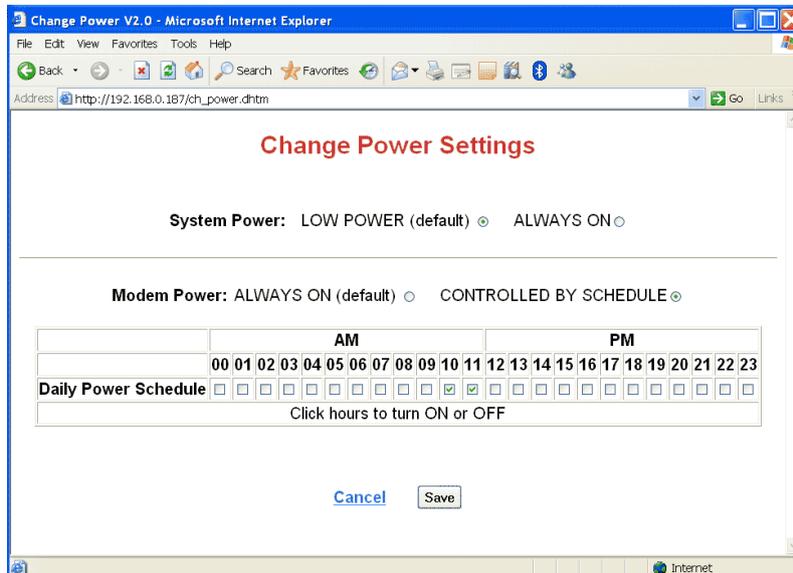
To control the hours of the day when the modem is on, simply click on the relevant box. In the example above, the modem will be on between 10:00 AM and 11:59 AM every day.

One Spider Controlling Another Spider via SMS

Spider AMR units fitted with software versions 1.33 or higher can control other Spiders via SMS.

This is accomplished by using alarms which send specialised SMS commands.

The three supported SMS commands are:

ON REMx	- to turn control x on the remote Spider ON
OFF REMx	- to turn control x on the remote Spider OFF
PLS REM x	- to pulse control x on the remote Spider ON and then OFF after 1 second

(x is the control number between 1 and 8 on the remote Spider).

As an example, we will consider a system comprising two Spiders. The local Spider is measuring a water level. Depending on the water level the local Spider sends SMS commands to the remote Spider to start and stop a pump controlled by the remote Spider.

There is no special setup required for the remote Spider. We will assume that the pump is controlled by CONTROL 3.

Lets assume that the remote pump should be on when the local water level is below 1m and should be off if the level is at or above 1m.

Setup a local Spider input to measure the water level.
Set an alarm to perform the pump activation as follows:

Operation:

1. When the water level goes below 1m the alarm will trigger.

2. The local Spider will send a special message to the remote Spider requesting that the remote Spider's CONTROL 3 be turned ON.
    (NOTE: The local Spider does not send 'On rem3', rather it sends a specially coded command containing its own time, alarm number and the desired action.)

3. If the remote Spider receives the special command and it is within 10 minutes of its own time, it will turn CONTROL 3 ON. It will then send a response SMS to the local Spider acknowledging the command and stopping further sending attempts by the local Spider. Go to step 6.

4. If the remote Spider does not receive the special command or the command is not within 10 minutes of its own time it will ignore the message but still send the acknowledgement command.

5. The local Spider's SMS acknowledge time is set to 3 minutes. If it does not receive an acknowledgement from the remote Spider within that time, it will re-send the special command. This process is repeated up to three times.

6. Auto Acknowledge time on the local Spider alarm is set to 60 minutes. Hence, 60 minutes after the alarm trigger, the alarm will be auto acknowledged (if not already acknowledged by the remote Spider). This will allow the alarm to send a new series of SMS commands if the water level goes inactive (above 1m) and the 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, setup another alarm on the local Spider to turn the pump off. Its trigger should be Water level ABOVE 1m and the Message should be 'Off rem3', with all other setting identical to the alarm described previously.

NOTES:

1. All alarm settings discussed above are examples only. You will need to adjust these as appropriate for your application.

2. The transmitted SMS commands are time stamped and acted upon by the receiving Spider only if the reception time is within 10 minutes of the command time stamp. This minimises the possibility of false commands caused by network delays, SMS delivery failures etc.

3. Reception of all remote SMS commands, whether within the allowed period or not are logged by the remote Spider.

Remote control via SMS is supported only if both Spiders are fitted with AMR software version 1.00 or standard software version 1.33 or higher.

Remote control is supported only with the 'On remx', 'Off remx' and 'Pls remx' SMS commands.

Attempting to use remote control with earlier software versions or other commands may result in endless loops, excessive SMS transmissions and very large phone bills!

Software Upgrade

Spider AMR operating software can be upgraded both locally and remotely. Detailed upgrade instructions are provided with new software.

Appendix A: Spider Inputs

INPUT TYPE	LOGGING METHOD	LOGGING RESOLUTION	ALARM TRIGGER CHOICES	TYPICAL USE	COMMENT
SWITCH	AUTOMATIC	Within 5 s of change	ON STATE OFF STATE	Switches, Status indicators, level (float) switches	Must be stable for a minimum of 5 s. Current state 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 (<= 10Hz) output	Counter rolls over from 999,999 to 0. Current count recorded every midnight.
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 (<= 10Hz) output	Each logged data point is the number of pulse in the previous scan period, multiplied by the scaler. Totalised counter value recorded every midnight.
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.
WIRELESS COUNTER	EVERY SCAN PERIOD	AS SET BY USER (SCAN PERIOD)	RATE OF CHANGE	Pulse type flow meters, any sensor with a low frequency (<= 5Hz) output	Counter rolls over from 999,999 to 0. Current count recorded every midnight.
WIRELESS 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 (<= 5Hz) output	Each logged data point is the number of pulses in the previous scan period, multiplied by the scaler. Totalised counter value recorded every midnight.
WIRELESS ANALOGUE	EVERY SCAN PERIOD	AS SET BY USER (SCAN PERIOD)	ABOVE BELOW RATE OF CHANGE	Most voltage and current sensors: temperature, pressure, signal strength etc.	12-bit resolution.
SYSTEM MONITORS	SIGNIFICANT CHANGE	AS SET BY USER (SCAN PERIOD)	ABOVE BELOW	Built-in system monitors: battery charger status, battery voltage and system temperature	10-bit resolution. Current value recorded every midnight.
DISABLED	-	-	-	-	Disabled inputs are removed from all display screens.

Appendix B: Connecting to a Spider

Local Connection

Ensure that the Spider AMR and your PC have matching network parameters. (Please refer to Appendix C for details.)

Connect the Spider AMR to your network. If you want to connect your PC directly to the Spider AMR, you can use the red "cross-over" network cable supplied with the Spider.

Turn on the Spider AMR by pressing the button on the front panel. (The unit must be turned on, i.e. the display must be showing something before you can establish a local connection.)

Start an Internet browser program such as "Microsoft Internet Explorer" on your PC. Type:
> **192.168.0.189**

as the web address and press the return or enter key.

(If you changed the default IP address as described in Appendix C, then enter the new IP address instead.)

The Spider AMR log-on page will be displayed on your PC. Enter your username and password in the spaces provided. (Default values are "user" and "changeme" respectively.) Click on the "Log in" button.

Alarms page will be displayed immediately following a successful log-on. You can now examine other pages as described in "Connecting to a PC"

IN CASE OF DIFFICULTY

If you cannot connect to a Spider, check the following settings in your browser (Internet Explorer 6 is described here, other browsers are similar):
1. Disable automatic dialling (In IE6: Tools->Internet Options->Connections, select "Never dial a connection")
2. Disable proxy servers (IN IE6: 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 Spider, refer to Appendix C for more information.

Remote Connection

Ensure that you have set up a dial-up connection as described in Appendix D.

Double click the connection icon.

Leave "User name" and "Password" blank and click "Dial".

Wait for the connection to be established. It may take up to 1 minute. Various messages will be displayed on the PC screen indicating progress e.g. Dialling, Verifying Username and Password, Connecting to network etc.

Once the connection is established, start an Internet browser program such as "Internet Explorer" on your PC.
Type:
   192.168.0.189

as the web address and press the return or enter key.
(This address <u>does not</u> change – even if you changed the default IP address as described in Appendix C.)

The Spider AMR log-on page will be displayed on your PC. Enter your username and password in the spaces provided. Click on the "Log in" button.

Alarms page will be displayed immediately following a successful log-on. You can now examine other pages as described in "Connecting to a PC".

When finished, make sure you terminate the link (hang up the call) as appropriate for your operating system.

Appendix C: Local Network Configuration

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

This Appendix describes two most common ways of network connection.

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

Connecting a PC Directly to a Spider AMR

The following procedure assumes that the following is true:

- You will be connecting your PC directly to the Spider using the supplied "cross-over" cable
- "EASY CONNECT" on the Spider is enabled. (Spiders are shipped from the factory with EASY CONNECT enabled.) You can check the setting by pressing the front panel switch repeatedly until the EASY CONNECT page is displayed.
- 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 section.

If any of the above are not true, proceed as described in the section "Connecting to an Existing Network" later in this Appendix.

Use the supplied red "cross-over" network cable to connect your computer LAN port to the Spider LAN port.

Turn on the Spider AMR by pressing and holding the button on the front panel for two seconds. (The unit must be turned on, i.e. the display must be showing something before you can establish a local connection.)

Start an Internet browser program such as "Microsoft Internet Explorer" on your PC. Type:
> **192.168.0.189**

as the web address and press the return or enter key
.
The Spider AMR log-on page will be displayed on your PC. Enter your username and password in the spaces provided. (Default values are "user" and "changeme" respectively.) Click on the "Log in" button.

Alarms page will be displayed immediately following a successful log-on. You can now examine other pages.

AUTOMATIC IP ADDRESS SETTING CHECKLIST FOR YOUR PC

1. Click on "Start"->"All Programs"->"Accessories"->"Communications"->"Network Connections"
2. If in the newly opened window 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

Connecting to an Existing Network

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

Change the Spider AMR default IP address and mask to the new values as follows:

1. Keep on briefly pressing the keypad key until the display shows
   I192.168.000.189
   M255.255.255.000
2. Press the keypad key and hold it pressed for more than 3 seconds. Release the key. The display will show
   Change IP addr ?
   192.168.000.189
3. Press the keypad key and hold it pressed for more than 3 seconds. Release the key. A flashing cursor will appear over the first digit on the second line.
4. A brief key press will increment the digit under the cursor, while a long press (longer than 3 sec) will move to the next digit
5. After the last digit is entered, the display will again show the message in step 2.
6. Briefly press the key. The display will show
   Change net mask?
   255.255.255.000
7. If you need to change the mask enter the change mode with a long press and then change digits in the same manner as described in step 4. above.
8. After the last digit is entered, the display will again show the message in step 6. Briefly press the key until the display shows
   Save ?
9. A long press will save the new values of IP address and mask and return the display to normal operation.
10. If you change your mind and don't want to change the values, exit the change mode (indicated by the flashing cursor) by waiting for 20 seconds, then briefly pressing the key until the display shows
    Cancel ?
    A long press now will cancel all changes and return the display to normal operation.
11. You must power down and then power up the Spider for the new values to take effect.

You can connect the Spider AMR to your network with a standard RJ-45 network cable. Cables of various lengths are available from Halytech and most electronics and computer retailers.

Once connected, you can connect to the Spider from any computer on your network as described in Appendix B – Local Connection.

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

Appendix D: Remote Access Configuration

Spider AMR uses standard PPP and TCP/IP protocols for remote access via telephone.

Internet access is NOT required. Your computer will call a Spider AMR directly.

A dial-up connection to the Spider is set up identically to setting up a dial-up connection for a typical Internet Service Provider (ISP). No special procedure is required apart from specifying the telephone number of the particular Spider AMR.

Your computer must have a modem and Dial-up Networking installed. The following procedure assumes that the both are present and installed correctly. If this is not the case, install a modem by following its manufacturer's instructions and then install Dial-up networking using instruction supplied with your operating system.

Dial-up networking configuration varies with different operating systems. Here is a brief guide for Windows XP and Windows 98. (Other operating systems will be similar.)

Windows XP:

1. Click on "Start"->"All Programs"->"Accessories"->"Communications"->"Network Connections"
2. Click on "Create a new connection" in the top left corner of the new window; "New Connection Wizard" will open
3. Click "Next"
4. Select "Connect to the Internet" and click "Next"
5. Select "Set up my connection manually" and click "Next"
6. Select "Connect using a dial-up modem" and click "Next"
7. Select your modem from the list and click "Next"
8. Type a name for this Spider connection e.g. "Spider at Greenwood" and click "Next"
9. Type the Spider telephone number into the "Phone number" field and click "Next"
10. Leave "User name:", "Password:" and "Confirm password:" blank, deselect "Make this the default Internet connection" and click "Next"
11. Select "Add a shortcut to this connection to my desktop" and click "Finish"

Windows 98:

1. Double click on the My Computer icon on your Windows Desktop
2. Double click on the Dial-up Networking folder
3. Double click on Make New Connection
4. Type a name for this connection e.g. Spider at Greenwood
5. Select your modem from the drop down list
6. Click Next
7. Leave Area Code field blank and type the Spider telephone number into the Telephone Number field
8. Click Finish
9. Right click on the new connection icon just created, then select properties
10. Make sure that the phone number is correct and that the Area code is blank
11. Click on Server Types
12. The type of Dial Up Server should be set to PPP, Internet, Windows NT, Windows9x
13. Under Advanced Options only Log on to Network and Enable Software Compression should be ticked
14. Under Allowed network protocols only TCP/IP should be ticked
15. Click TCP/IP Settings button

16. Make sure that Server assigned IP address, Server assigned name server addresses, Use IP header compression and Use default gateway on remote network are selected.
17. Click OK
18. Click OK

You can now call the remote Spider AMR by clicking on the newly created connection icon as described in Appendix B – Remote Connection.

NOTE: If your organisation operates more than one Spider AMR, you will need a separate connection icon for each Spider.

Appendix E: Logged Data Format

Spider AMR 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.

Each record in the file consists of four fields:
1. record date e.g. 14/05/03
2. record time e.g. 12:34:15
3. record numeric identifier
4. record text description or in the case of analogue and counter inputs, the value of the input

The following table lists all possible values for the numeric identifier and the text fields.

Numeric Identifier	Range	Text	Comment
32768	32768	New File	New log file created
32769	32769	NORML ST	Normal program start
32770	32770	PHONE ST	Phone program start
32771	32771	MODM ON	Modem came on-line
32772	32772	MODM OFF	Modem went off-line
32773	32773	RING DTC	Incoming ring detected
0 + IN#	0 – 10	Numeric value of analogue / system input	Analogue / system input log record
20 + IN#	20 - 27	Numeric value of counter input	Counter input log record
50 + 2*IN# + STATE	50 – 65	STx=y	Digital input change
80 + IN#	80 - 87	Numeric value of event counter at the time of the event	Event input log record + event counter
100 + 2*CNT# + STATE	100 – 115	CNx=y	Control change
140 + IN#	140 - 147	Numeric value of event counter at midnight	Event input midnight check (no event occurred)
160 + IN#	160 - 167	Numeric value of daily rain total at the time of the event	Daily rain input log record + total
180 + IN#	180 - 187	Numeric value of daily rain total at midnight	Daily rain input midnight check (no event occurred)
200 + AL#	200 – 207	Alarm x	Alarm activation
280 + AL#	280 - 287	Almx RST	Alarm reset
300 + 10*AL# + SEQ	300 - 379	SMSxy OK	SMS alarm transmission OK
500 + 10*AL# + SEQ	500 - 579	SMSxy NG	SMS alarm transmission failed
700 + AL#	700 – 707	SMS ALxK	SMS command – acknowledge an alarm
718	718	SMS ALLK	SMS command – acknowledge all active alarms
719	719	SMS AL?K	SMS command – acknowledge an invalid alarm #
720 + 2*CNT# + STATE	720 – 735	SMS CxOF or SMS CxON	SMS command – (de) activate a control

758	758	SMS BPIN	SMS command – (de) activate a control – invalid PIN
759	759	SMS C?OF or SMS C?ON	SMS command – (de) activate a control – invalid control #
760	760	SMS GTST	SMS command – get inputs
761	761	SMS GTCN	SMS command – get controls
762	762	SMS HELP	SMS command – get help
763	763	SMS GTSY	SMS command – get system inputs
764	764	SMS GTRP	SMS command – get daily report
797	797	SMS ROK	SMS command acknowledgement sent OK
798	798	SMS RNG	SMS command acknowledgement send failed
799	799	SMS ????	Unknown SMS command
800 + 2*CNT# + STATE	800 – 815	RMG CxOF or RMG CxON or RMG CxPL	SMS remote command – (de) activate a control
820 + 2*CNT# + STATE	820 – 835	RMB CxOF or RMB CxON or RMG CxPL	SMS remote command – (de) activate a control – outside allowable time
860 + CNT#	860 – 867	SMS CxPS	SMS command – pulse a control
900 + IN#	900 – 907	Numeric value of utility meter input	Utility meter input log record
1000 + 10*AL# + TRY	1000 - 1073	EMLxz OK	e-mail sent OK
1200 + 10*AL# + TRY	1200 - 1273	EMLxz NG	e-mail sending failed
1300 + TRY	1300 - 1302	EMREP OK	Automatic e-mail report sending successful
1310 + TRY	1310 - 1312	EMREP NG	Automatic e-mail report sending failed
1320 + TRY	1320 - 1322	FREP OK	Automatic FTP report sending successful
1330 + TRY	1330 – 1332	FREP NG	Automatic FTP report sending failed
1600 + 10*AL# + TRY	1600 - 1673	VOCxz OK	Voice alarm sent OK
1800 + 10*AL# + TRY	1800 - 1873	VOCxz NG	Voice alarm sending failed
2000 + 10*TR# + IN#	2000-2993	Numeric value of wireless counter input	Wireless counter input log record. e.g. the second input on transmitter 35 is 2341
3000 + 10*TR# + IN#	3000-3993	Numeric value of wireless utility meter input	Wireless utility meter input log record. e.g. the third input on transmitter 17 is 3162
5000 + 10*TR# + IN#	5000-5993	Numeric value of wireless analog input	Wireless analog log record. e.g. the third input on transmitter 17 is 3162

4000+TR#	4000-4099	aaaab cccc	Communication status with wireless transmitters. Not all messages indicate error – see below for decoding the message. The ID indicates which transmitter had the fault
		WINFO TIME	Normal operation – the Spider synchronises with all transmitters weekly
		WWARN TIME	Normal operation – the Spider had to synchronise this transmitter earlier than normal due to clock drift
		WWARN INIT	Normal operation if it only occurs once per transmitter after a configuration change – the Spider had to initialise this transmitter
		WERR1 cccc	Non-serious errors. May indicate a problem if occurring regularly. See below for meaning of cccc
		WERR0 cccc	Errors that happen twice in a row. The Spider may still be able to recover without data loss. See below for meaning of cccc.
		WERR0 RX	Indicates a fault with the wireless receiver or its cable
		WERR0 TX	Indicates a fault or signal loss with the endpoint transmitter (on the meter)
		WERR0 REPd	Indicates a fault or signal loss with repeater #d. NOTE: In some circumstances the fault may actually be the next transmitter in the chain.
		WERR0 CFG WERR0 COM WERR0 FRM WERR0 TOUT	Unlikely errors that may indicate a fault if happening regularly. Contact Halytech

Table decode:

IN#	-	input number:
		0 – 7 are user inputs
		8 is battery charger status
		9 is battery voltage in V
		10 is system temperature in deg C
TR#	-	wireless sensor module number minus one (0-49)
STATE	-	digital input state (0 = OFF, 1 = ON)
CNT#	-	control number (0 – 7)
AL#	-	alarm number (0 – 7)
x	-	alarm number (1 – 8) (equals AL# + 1)
SEQ	-	alarm sequence step (0 – 10)
y	-	alarm sequence number (1 – 9) (equals SEQ + 1)
TRY	-	e-mail sending attempt (0 – 2)
z	-	e-mail sending attempt (1 – 3) (equals TRY + 1)
aaaa	-	Wireless error severity
b	-	Wireless error retries remaining
cccc	-	Wireless error type code
d	-	Wireless error repeater number

Appendix F: 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

Appendix G: Connection to Mobile Network

Spider AMR units are fitted with a GSM or NextG modem. You will need to connect to a mobile telephone network by following one of the two procedures below, as applicable for your unit.

GSM Network

Spider AMR units fitted with an internal GSM modem must be connected to a GSM network to make them fully operational.

Contact your telecommunications provider and request a connection. This is typically a two-step process. Firstly a standard voice SIM card is required. It comes with a VOICE telephone number. You will also need a DATA telephone number. This number is sometimes called "a data terminating number" or "a data service", depending on carrier. The data number usually requires an additional monthly charge.

The data service type required is "NON-TRANSPARENT, ASYNCHRONOUS".

If your Spider AMR is fitted with the e-mail option and you wish to send e-mails by using GPRS, request that GPRS be enabled.

You can use either the voice or the data number to send SMS commands to the Spider.
Use the data number to dial a Spider with your computer and a modem.
Use the voice number to listen to the synthesised voice (if voice option installed).

Insert the SIM card into your Spider AMR as described in the next section.

SIM Card Insertion and Removal (GSM units only)

Before inserting a SIM card into a Spider AMR, insert it into a standard GSM mobile telephone. Turn the telephone on and ensure that any PIN protection is turned off and that you can make and receive normal calls.
(PIN protection can usually be turned off in the Security Menu of your phone.)

You can now remove the SIM card from the mobile phone and insert it into a Spider AMR as follows:

1. Locate the modem access cover located on the top of the Spider AMR case, next to the antenna connector. Using a small Phillips screwdriver, undo the single screw and gently pull out the cover. The modem inside the Spider will now be visible through the exposed access slot.

2. By looking through the slot, you will see the SIM card slot with a black locking lever to the left of it.
    Holding the SIM card <u>level with the locking lever</u>, gently push the SIM card into the exposed slot until it locks in. The notched end should be inserted first, with the gold contacts facing up – as shown in the illustration.

IMPORTANT: You should feel slight resistance while pushing the card into the slot. If you do not or you can freely move the SIM from side to side by more than 1 mm you have missed the slot. You must remove the SIM and try again!

3. Using a small flat screwdriver, slide the locking lever to the right – as far as it will go.
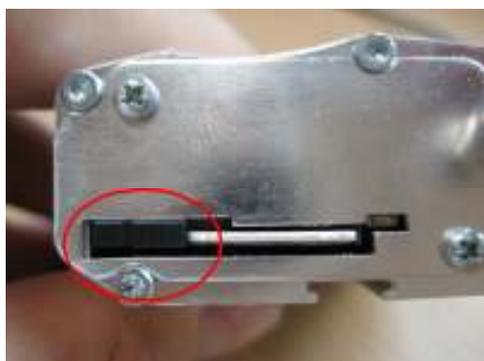
UNLOCKED POSITION   **LOCKED (WORKING) POSITION**

4. Replace the access cover.

To remove the SIM card:

1. Remove the modem access cover as previously described.

2. Using a small flat screwdriver, slide the SIM locking lever to the left as far as it will go.

3. Gently push the SIM card into the modem – it will unlock and partially pop out.

4. Pull out the SIM card completely.

SIM Card Insertion and Removal (NextG units only)

Before inserting a SIM card into a Spider AMR, insert it into a standard NextG or a GSM mobile telephone. Turn the telephone on and ensure that any PIN protection is turned off and that you can make and receive normal calls.

You can now remove the SIM card from the mobile phone and insert it into a Spider AMR as follows:

1. Remove the connector panel by undoing two screws shown in the picture.

2. Eject the SIM card holder by pushing the yellow button with a pen or a small screwdriver.

3. Insert the SIM card into the holder so that the gold pins are on top.

4. Insert the SIM card holder back into the modem.

5. Push the SIM card holder as far as it will go.

6. Re-install the connector panel and secure it with the screws removed in step 1.

Appendix H: Testing E-mail Connectivity

Spider AMR units fitted with e-mail options provide a quick and simple way of confirming proper e-mail operation.

You can send test e-mails at any time by using the built in keypad and display. E-mails are sent to the "Test e-mail address" as configured in the E-mail Settings browser screen.

Sending Test e-mails

Once you set up a new Spider and enter all required Network / E-mail parameters ensure that it is connected to the appropriate network as selected by the E-mail sending method. Repeatedly and briefly press the keypad key until the display shows:

Send test email?

Press and hold the key for longer than 3 seconds.
The unit will display:
Sending email…

The keypad will not respond to key presses while the above message is displayed. After a period of time (usually less than 30 seconds) the outcome will be displayed as

Email sent OK !   OR   **Email failed !**

A successful outcome verifies full e-mail connectivity. Otherwise, you may wish to Monitor Test e-mails to find the reason for the failure.

Monitoring Test e-mails

Equipment required:

1. Spider AMR with e-mail option, initialised Network / E-mail settings and connected to the appropriate network (LAN or mobile network)
2. PC running a terminal program such as Hyperterminal
3. straight-through serial cable

Procedure:

1. Set your terminal program to 9600 bps, 8 data bits, 1 stop bit and no parity
2. Connect your PC serial port to Spider AMR AUX2 port (the DB-9 connector on the outside of the enclosure).
3. Send a test e-mail as described above in "Sending Test e-mails"
4. Your PC will display diagnostic messages for each step of the sending process
5. The last message will usually indicate where the problem lies

Most diagnostic messages are self-explanatory. Here are some additional tips:

- "Unable to resolve 'your smtp host address'" message when using LAN e-mail sending method – ensure that the gateway and the primary and the secondary DNS are set correctly and that there is connectivity to the internet or to your SMTP mail host computer.
- Messages starting with 3-digit numeric codes are generated by the SMTP host computer and will indicate invalid sender, recipient etc. Your network administrator or ISP can supply correct settings.

Appendix I: Wireless Sensor Diagnostics

Wireless Sensor Diagnostics is provided as an interactive tool for direct communications with the wireless receiver and the wireless transmitter module(s). It allows users to interrogate them, verify their operation etc.

If you experience wireless input problems, the first step is to verify that the wireless receiver is connected to the Spider's AUX 2 port. Next check that the radio addresses of all enabled transmitter and repeater modules are entered correctly. If the problem is still present, you can use the Diagnostic mode to help you pinpoint the cause.

To enter the Wireless Sensor Diagnostics mode, access the "CHANGE SETUP" page as described in "Setting up a Spider AMR for the first time" earlier in this manual.

Select the module you wish to diagnose from the "Wireless Sensor Diagnostics" menu. The following page will be displayed:
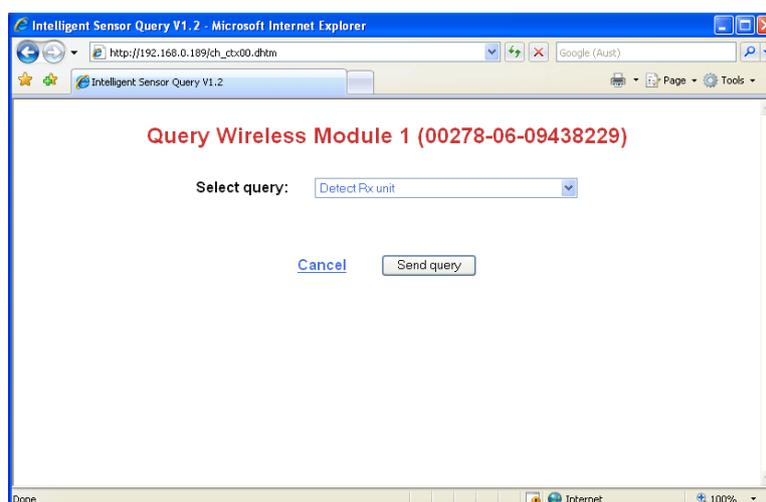

NOTE: This page is not available unless you have enabled at least one wireless input in the "Change Inputs" screen.

Select the query (command) from the drop-down list.
Click on the "Send query" button.

Some commands will provide an immediate response, while others may take a few seconds. If the response is not yet available, the following screen will be displayed:
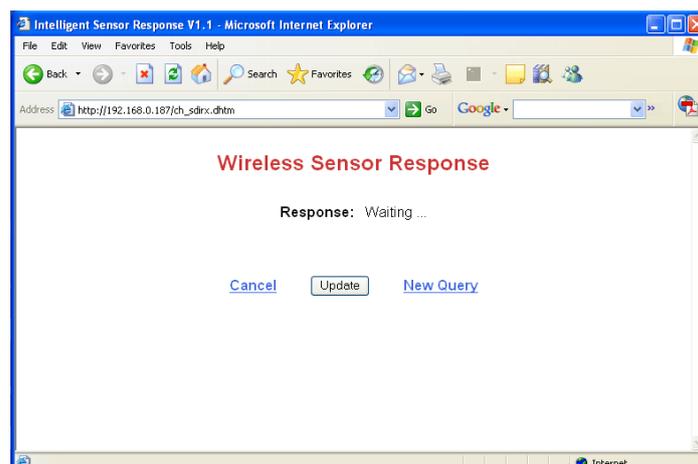
Click "Update" to check if the response is available. Repeat if necessary.
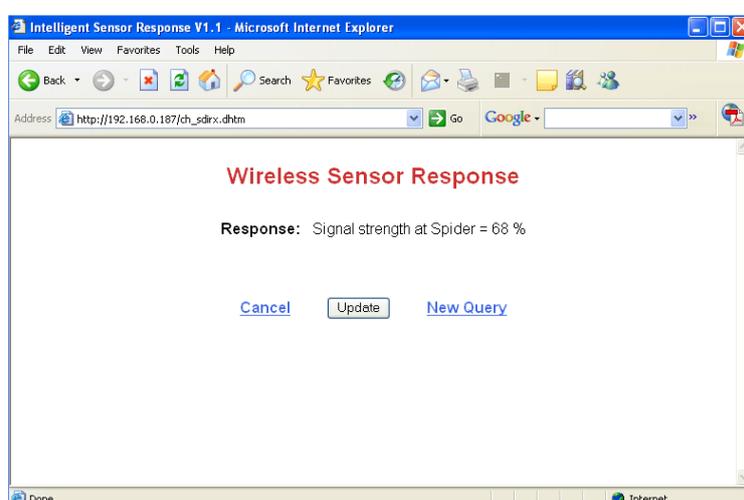
Available Queries (Commands) and their application is as follows:

1. **Detect Rx Unit**
   To confirm that the wireless receiver is connected to the Spider and that it is working properly.

2. **Raw count & battery status**
   To confirm connectivity with a remote transmitter and to check its battery status.

   NOTE: the "raw" count is different and separate from the Spider internal counter used by the particular wireless input. The "raw" count increments with every pulse. It is not scaled or preset.

3. **Signal strength between …**
   The options available here depend on wireless repeater configuration for the selected module. This option provides a measurement of communication quality between the Spider, Wireless Repeaters, and Wireless Transmitters.

NOTES:

Difficult installations with low signal strengths may be improved significantly by using a higher gain antenna available from Halytech and their distributors.

Such an antenna is fitted with a length cable enabling it to be installed in a more favourable position – elevated, in front of a wall etc.

It is important to note that if repeaters are in use then the signal strength must be adequate on each hop (spider to repeater, repeater to repeater or repeater to sensor), and that each strength must be checked with a separate query.

NOTES:

Appendix J: Differences between 'Spider SMS' and 'Spider AMR'

- Both systems support eight native (hardwired) inputs that can be setup as 'Switch', 'Counter', 'Utility Meter' and 'Analogue'. The other types supported by Spider SMS such as 'Event', "Daily Total' and 'SDI-12' are not supported in the 'Spider AMR' version.

- The Spider AMR allows the user to setup up to 100 wireless transmitters, each of which can be a quad type supporting up to 4 inputs. This allows the Spider AMR to log up to 400 wireless inputs in addition to the 8 native (hardwired) ones.

- In the Spider AMR, setup, calibration and display of wireless inputs is done on a per-transmitter basis. Calibration of wireless transmitters is mandatory and is entered automatically from the setup screen.

- The Spider AMR supports up to 3 repeaters for each wireless module. This allows a single system to cover a far greater area. The Wireless Diagnostics menu allows the user to determine signal strength between any transmitters in the wireless path.

- The wireless transmitters used by Spider AMR can store between an hour and a day of data depending on the logging period. The Spider AMR will poll its wireless transmitters only when necessary in order to conserve wireless module battery life. A manual history data download may therefore be missing the latest data; automatic reports are always sent after the data is received and are therefore complete. Alarms are also affected by this behaviour.

- Wireless inputs have a set of status flags associated with them that are displayed on the status webpage and on the display when viewing that input. These letters provide information such as communication problems, tamper detection and low sensor battery.

- Spider AMR does not support a timer schedule for controls.

- Speech Option is not available in the Spider AMR.

Appendix K: MODBUS Protocol Support (if installed)

The Spider has optional support for MODBUS over TCP/IP. If this option is purchased the Spider will act as a slave and accept connections from a management system on TCP port 502 via the LAN interface or dial-up.

The Spider only allows one connection at a time; if a second connection attempt is made the original connection will be closed. The Spider can handle approximately 10 MODBUS requests per second. The TCP layer will allow a small amount of queries to be queued.

For LAN access, the Spider **must be configured to run in "Always On Mode"** as otherwise the Spider will periodically power down to save power.

For dial-up access the management system should dial in via the Spider's data number, make the required MODBUS requests over the link and then hang up the connection. "Always On" is not needed for this method.

In the following discussion register addresses will be numbered starting from 0 as they are in the MODBUS protocol; however it is common for SCADA software to use point addresses specified with a 5- or 6-digit number where the first digit gives the type of register and the remainder is the register address plus one. E.g. the point address "300013" corresponds to input register 12. For this reason the examples will also give the point address in parenthesis.

When requesting a range of registers, the first register in the range must be valid or exception 02: Illegal Data Address will be returned. In general it is ok for the last register to be outside the valid address range – the invalid registers will simply return dummy data (value returned depends on function).

Reading / Changing Control Outputs (Function 01: Read Coils / Function 05: Write Single Coil)

For both of these functions, the address 0-7 corresponds to Control 1-8. A '1' or 'ON' status means that the control output is closed.

Setting a control's status has the same effect and priority as changing the control via the Spider's webpage. Therefore the Spider's built-in alarms (if enabled) will override a change made via MODBUS.

Example:

Control 3 can be read/written in register 2 (000003)

Obtaining Input Readings

Function 02: Read Discrete Inputs

This function returns an on/off logic state depending on the voltage level on the corresponding wired input, and is independent of the configuration of the input.

Valid addresses are 0-7. The returned value is inverted – a 1 means the input is grounded (i.e. the connected switch is closed). Invalid addresses will return '0'.

Example:
Input 3 is available in register 2 (100003)

Function 04: Read Input Registers

This function returns the reading that is displayed on the Spider's screen or web pages for the corresponding input (wired or wireless). If the input is configured as "Analogue" then the value is returned as an IEEE754 32-bit floating-point number. If the input is a "Counter" or "Utility" type, the number is r a 32-bit integer which is the displayed value multiplied by 1000.

As MODBUS registers are only 16-bit wide but the data is 32-bits, two consecutive registers are used, with the least significant 16 bits in the lower numbered register. **It is very important that all reads start on an even numbered register and end on an odd numbered register (e.g. registers 0 to 3).** If this condition is not fulfilled the Spider will return exception 02: Illegal Data Address, as otherwise invalid data could be read.

NOTE: Invalid or disabled inputs will return '1' for every bit position – this corresponds to "Negative Not a Number" (–qNaN) in the IEEE754 standard and should be detected as an error.

The address of the first register in the pair for a particular input is determined from the following table:

Input channel	First register of pair	Value
Native inputs 1-8	X * 2 - 2 where X is the input number (1-8)	Depends on input configuration – same as Spider's display
Charger	16	0.0 if off, 1.0 if on
Battery voltage	18	Reading in volts
Unit temperature	20	Reading in degrees Celsius
Wireless input	8182 + X * 8 + Y * 2 Where X is the transmitter number (1-100), Y is the input number on the transmitter (1-4)	Depends on input configuration – same as Spider's display

Examples (the point address given is the first of the pair):

Native input 3 is available in registers 4-5 (300005)
The second wireless input on transmitter 5 is available in registers 8224-8225 (308225)

Obtaining Input Status (Function 03: Read Holding Registers)

In addition to the current input reading, each input has some associated status information available as a single 16-bit holding register per input. Alarm status is also available via this method.

This information is particularly useful for wireless inputs as it notifies the user of low transmitter battery, input tampering (for WaveFlow) and whether the last wireless communication failed. A '1' in the specified position indicates that a fault is detected.

NOTE: isolated communication errors do not necessarily indicate a fault with the transmitter. It is recommended that a delay of at least two log periods is added to alarms checking this kind of fault to eliminate false alarms.

To simplify alarm conditions, an extra status register (address 8191) is available which combines all the enabled wireless inputs – this register contains a '1' if ANY enabled wireless input shows the fault. It is recommended that users periodically check this register for a value greater than 511 as it indicates a fault with an input.

The address of the register corresponding to a particular input and the encoding of the data is determined from the following table:

Input channel	First register of pair	Value
Native inputs 1-8	X – 1 where X is the input number (1-8)	Low byte = Type Code
Alarm 1-8	X + 127 where X is the alarm number (1-8)	Bits 3-0 = SMS status code Bits 11-8 = Email status code Bit 15 = Alarm Trigger Active
Wireless input (specific)	4091 + X * 4 + Y Where X is the module number (1-50), Y is the input number on the module (1-4)	Low byte = Type Code Bit 8 = Communication error Bit 9 = Low transmitter battery Bit 10 = Tamper detected
Any wireless input	8191 (408192)	Bit 8 = Communication error Bit 9 = Low transmitter battery Bit 10 = Tamper detected

Examples:

Alarm 3's status is available in register 130 (400131)
The second wireless input on module 5 is available in register 4113 (404114)

Many of the inputs give a "Type Code" as part of their response this is decoded as follows:

Type Code	Input Type
0	Disabled
1	Digital
2	Counter
3	Analogue
7	Utility Meter
8	Wireless Counter
9	Wireless Utility Meter
10	Wireless Analogue

Supported MODBUS Function Codes

Use of any function not listed will generate exception 01: Illegal function.

Function code (decimal)	Use in Spider
01: Read Coils	Get on/off status of control outputs
02: Read Discrete Inputs	Get on/off status of inputs (regardless of configuration)
03: Read Holding Registers	Get status information about configured inputs and alarms
04: Read Input Registers	Get current reading of configured inputs – all values returned as either IEEE754 32-bit floating point or 32-bit integer as a pair of consecutive registers – both address and number of registers in request must be even
05: Write Single Coil	Change on/off state of control output – identical outcome to webpage access
43/14: MEI / Read Device Identification (Basic)	Gives product name and software version.