

# microSpider2 Satellite

## User Guide



microSpider2 Satellite User Guide Version 1.01  
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## Preface

This user guide describes operation specific to the microSpider2 Satellite.

It does not cover topics common to all microSpider2 units. Please refer to the standard microSpider2 user manual for all other information.

## Revision History

<i>Document Version</i>	<i>Release Date</i>	<i>Comments</i>
V1.00	01/06/2017	Developed from microSpider Mk1 Satellite user guide
V1.01	21/07/2017	Updated Sample SBD Email wording.

## Introduction

The microSpider2 Satellite is capable of sending data from anywhere on the Earth with a view of the sky. This is achieved through an on-board Iridium Satellite Short-Burst-Data (SBD) modem, which can send data via the global Iridium Satellite network. This on-board Iridium SBD modem takes the place of the microSpider2's 3G modem, and so the microSpider2 Satellite is targeted towards use in remote locations with unreliable or no access to the phone network.

Any SBD message, including SBD reports, which are sent by the microSpider2 will be automatically delivered as an attachment to an email by the Iridium network system. The recipients of these emails are specified in your Iridium network account rather than in the microSpider2. A sample SBD email and description can be found later in this document.

SBD messages sent over the Iridium Satellite network are often charged per byte, which means that longer/larger messages incur a higher cost. To address this, we have developed special compressed SBD report formats which minimise the amount of data sent over the Iridium network. This significantly reduces the on-going running cost of the microSpider2 Satellite system.

Because the data is sent in the special compressed report formats, all SBD messages received from the microSpider2 Satellite need to be decoded before the data can be viewed in a readable format. This step is as simple as inputting the received SBD data file into the supplied SBD decoder program, and can even be automated. A more detailed description of the various report format types can be found later in this document.

## microSpider2 Satellite System

The microSpider2 Satellite system is supplied with the following items:

- microSpider2 unit with built-in Iridium SBD satellite modem
- Iridium low-profile antenna with male SMA connector
- 5m RF cable

The microSpider2 Satellite is packaged in the same case as either the microSpider2 Industrial or microSpider2 Environmental.

### ***Important Notes***

The microSpider2 Satellite unit **must be connected to a 12V battery** to ensure reliable satellite communications. This is due to the fact that the satellite modem draws large currents over very short periods of time. Solar and Mains Chargers are not able to supply the required peak currents on their own.

It is also important to keep the lead between the battery and the microSpider2 Satellite as short as possible.

If you have the microSpider2 Satellite Environmental, the battery must be connected to the 'External Power In' pin (I/O Connector 1, Pin 8).

On the microSpider2 Satellite Industrial, the battery must be connected to the 'BT+' pin.

## Differences

Since microSpider2 Satellite units are equipped with an Iridium Satellite modem in place of a 3G modem, they are unable to access the 3G phone network and therefore don't have mobile internet. This leads to a number of differences between Satellite and 3G microSpider2 units, which are outlined in the following sections.

In addition to the changes specified below, the microSpider2 Satellite, without access to mobile internet, will not have the following features: Twitter, Email, DNP3, Automatic Setup Updates, and Automatic Software Upgrades.

## Alarms

The Alarms page no longer shows options for Email, SMS, and Twitter alerts since this is not possible using the Iridium SBD modem.

**microSpider2**  
Industrial Satellite

[Home >> Change Setup >> Alarm](#)

### Change Alarm 'Rainfall'

[? Help](#)

Alarm name

Trigger source

Trigger level

Qualifying time  second(s)

[Hide More Settings](#)

Control action

Fast logging

Auto acknowledge time  minute(s)

05-05-2017 14:15:23  
microSpider2 v1.32  
Device 112233  
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## Network

The Network Settings page only contains settings for Local Area Network connections (LAN), since a Wide Area Network (WAN) is not available.



**microSpider2**  
Industrial Satellite

Home >> Change Setup >> Network

**Change Network Settings** [? Help](#)

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

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

[x Cancel](#) [✓ Save](#)

05-05-2017 14:24:25  
microSpider2 v1.32  
Device 112233  
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## Date and Time

The Date and Time Settings page no longer contains reference to NTP time synchronisation since this is no longer possible using an SBD modem.



**microSpider2**  
Industrial Satellite

Home >> Change Setup >> Time / Date

**Change Time and Date Settings** [? Help](#)

**Time and Date**

**Current date**

**Current time**    (hh:mm:ss) - 24 Hour

**Time zone**   (Sydney is +10:00)

[Set from computer](#)

[x Cancel](#) [✓ Save](#)

05-05-2017 14:25:51  
microSpider2 v1.32  
Device 112233  
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## Reports

The Change Report Settings page shows options for SBD reporting. FTP, HTTP and Email reporting options are not available.

The screenshot shows the 'Change Report Settings' page for 'microSpider2 Industrial Satellite'. The page has a blue header with the Halytech logo and the product name. Below the header is a navigation bar with 'Home >> Change Setup >> Reports'. The main content area is titled 'Change Report Settings' and contains a 'SBD Report' section. This section has a green header and contains the following options: 'Send Report' with radio buttons for 'Disable' and 'Enable' (selected); 'Report Frequency' with a dropdown menu set to '1 hour'; 'Format' with a dropdown menu set to 'Type 12 (History Included)'; 'Include System Channel Readings' with a dropdown menu set to 'Standard'; and 'Number of Attempt Windows' with a dropdown menu set to '1'. Below the SBD Report section is a 'Reset Report Starting Point' section with a green header and a text box explaining that clicking the button prevents existing data from being included in the next automatic report. A button labeled 'Reset starting point' is located below the text box. At the bottom of the page are two buttons: 'Cancel' and 'Save'.

The SBD reporting options are:

- **Report Frequency:** How often SBD reports are to be sent out. This is a time period and can be set to: 20 minutes, 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 6 hours, 12 hours, or 1 day.
- **Format:** there are a number of different SBD report formats to choose from, each having different trade-offs between size and content. The different report formats are outlined in the next section.
- **Include System Channel Readings:** Report formats type 12 and 13 can optionally include the current battery and system temperature readings, in addition to the usual historical data.  
The following system channel options can be selected:
  - **Disabled:** No system channels are included, even if some system channels have been setup in Change Input Setup
  - **Standard:** Whichever system channels have been setup via the Change Input Setup page are included, in the same way as standard channels
  - **Legacy:** System channels are setup and included as per the first generation microSpider: a single reading of the system channels (External Power and System Temperature) is included in the header. Any other system channels which have been setup are not reported.
- **Number of Attempt Windows:** How many times to attempt to send the report

## Input Setup

The Inputs page contains some additional settings for each channel which are specific to microSpider2 Satellite units:

- **SBD ID:** In SBD type 11 reports this number is the user-assigned ID that shows up on SBD reports in order to identify the channel at the receiving end. It is a value between 0 and 255.
- **Include in SBD report:** If enabled, the channel will be included in the periodic reports sent out over SBD
- **SBD Spacing:** Because SBD messages cost more the more data is sent, it is often convenient to limit how often a channel's readings are reported over SBD without changing the logging period. This setting lets you select how often this channel is to be reported via SBD.

The screenshot shows the 'Change Input Setup' dialog box. The background is a table of input channels with columns: Type, Source, Name, User ID, SBD ID, Units, and Logging. The table has 19 rows. Row 1 is 'Counter' with Source 'Digital 1', Name 'Rainfall', User ID '0', SBD ID '0', Units 'mm', and Logging 'General'. Rows 2-18 are 'Disabled'. Row 19 is 'System (Voltage)' with Source 'External Power', Name 'External Power', User ID '18', SBD ID '18', Units 'V', and Logging 'General'. The 'Options' panel is overlaid on the table. It has a title 'Options' and a '? Help' button. A message says: 'This channel's options have been changed from their defaults. Changed options are highlighted in orange.' The panel contains the following settings: 'Default ID' is 0; 'Log difference in reading over logging period' is unchecked; 'Minimum change required to log' is 0.000; 'Periodic reset' is Off; 'Include in SBD Report' is checked; 'SBD Spacing' is 'Same as logging'. There are 'Cancel' and 'OK' buttons at the bottom.

For example: A microSpider2 is set up to log one counter channel in addition to the battery voltage. You wish to receive an SBD report every 6 hours and have it contain 15-minute counter readings and 3-hourly battery voltage readings. To achieve this, you would:

- Enable SBD reporting and set the format to type 12 or 13 (since type 11 cannot contain historical data, as described in the Report Format Types section)
- Set the logging period to 15 minutes
- Set the 'SBD record spacing' on the battery voltage channel to '3 hours'
- Set the 'SBD record spacing' on the counter channel to '15 minutes'

This will result in SBD reports that contain 24 counter readings (a reading every 15 minutes over a period of 6 hours), and 2 battery voltage readings (a reading every 3 hours over a period of 6 hours).

**Note:** Event and switch channels cannot be included in SBD reports, because they do not have a fixed logging period.

## Report Format Types (Overview)

Each report format has different trade-offs between size and content. The different report types are detailed in the following sections.

### **Type 11**

Type 11 reports contain the following data

- The first 2 characters of the device location name
- The time at which the report was sent
- Simple channel configuration information (eg: identifying channels as counter, analogue, switch, etc)
- The state of any alarms (active/inactive)
- The state of any controls (on/off)
- The SBD ID and the *current* value of all SBD-enabled channels

Note that type 11 reports contain only the most recent channel readings without any historical channel data. A different report format type should be selected if historical channel data is required.

### **Type 12**

Type 12 reports are used to send a history of channel data, and include the following data:

- The logging period
- The SBD reporting period
- The time at which the report was sent
- Optional: The current battery voltage and system temperature, if system channel reporting is set to Legacy mode
- A history of logged channel values for all SBD-enabled channels

### **Type 13**

Type 13 reports contain the same information as type 12 reports except that the historical channel values are compressed. This compression equates to a saving of 1 byte per channel reading when compared with report type 12.

For example: a type 12 report containing 48 channel values will be 204 bytes in total (including headers and channel data). With a saving of 1 byte per reading, choosing report type 13 will reduce this to a total of 156 bytes per report (a 23% saving).

Note that the saving in report size comes at the cost that each reported channel value will have slightly reduced accuracy. For most applications this is not an issue, but depending on the specific application requirements, report type 13 may or may not be a suitable choice.

### **Type 0**

Type 0 report contains a response to commands sent to the unit. This will include the first two characters of the Location Name, the current time, the number of successfully processed variables and the total number of variables found in the command.

## Report Format Types (Detailed Specification)

The following information is relatively technical and intended for programmers or other personnel involved in implementing a custom SBD decoder. This is often not necessary since Halytech can provide a working decoder program for your use.

This section describes the binary makeup of the various SBD format types, so that custom report decoders can be written if required.

### **Type 11**

Each message is composed from a 19 byte header and a data section of 5 bytes per input. The header contains information about the microSpider2 input configuration and the current state of all alarms and controls, and the data section contains the current readings of selected channels. The binary makeup of the header and data sections are given below.

Header:

FIELD	SIZE (bytes)	CODING	COMMENT
Message type	1	none	Set to 11 in this type
microSpider2 ID	2	none	First 2 characters of microSpider Location
Date / time	4	long int	Time in seconds since 00:00:00 1/1/1970
Input configuration	15	long int	6 bits per microSpider input
Alarm status	1	1 bit per alarm	LS bit first, set if alarm active
Control status	1	1 bit per status	LS bit first, set if control currently on

Data (repeated for each input):

FIELD	SIZE (bytes)	CODING	COMMENT
Input SBD ID	1	none	As set by user
Input value	4	float	32-bit IEEE format

Note: all multi-byte formats use the Intel convention of storing the lowest significant byte (LSB) first.

The 'Input configuration' field in the header gives the setup information for 20 microSpider2 inputs. Each input takes 6 bits. Configuration of the 1<sup>st</sup> input is in the lowest 6 bits of the least significant byte, and progresses up to the top 6 bits of the most significant byte which holds the configuration of the 20<sup>th</sup> input.

The coding for each of the 6 bits groups is as follows:

- 0 Disabled
- 1 Switch
- 2 Counter
- 3 Analogue voltage
- 4 Analogue 4-20mA
- 5 Event
- 6 Quadrature
- 7 (unused)
- 8 Differential
- 9 SDI-12
- 10 Modbus
- 11 (unused)
- 12 (unused)
- 13 (unused)
- 14 System temperature
- 15 System voltage
- 16 System moisture

### Type 12 and Type 13

Report format types 12 and 13 share the same header structure and have very similar data structures, with the only difference being that type 13 has 3-byte ('compressed') channel values while type 12 has 4-byte channel values.

#### Header:

FIELD	SIZE (bytes)	CODING	COMMENT
SysInc / type	1	none	Bit[7:7]: 'system input included?' Bit[6:0]: Type (12 or 13)
Device settings	1	none	Bit[7:4]: SBD report period ID Bit [3:0]: microSpider2 log period ID
Date / time	4	long int	Time in seconds since 00:00:00 1/1/1970
Channel record count	10	long int	One 4-bit record count ID for each of the 20 channels
Battery Voltage	1	none	Included only if bit 7 of 'SysInc / Type' is set to 1. This is the battery voltage reading multiplied by 10 (ie: $V * 10$ )
System Temperature	1	none	Included only if bit 7 of 'SysInc / Type' is set to 1. This is the temperature plus 40 (ie: $T + 40$ )

The SBD report period ID is a 4-bit number index of SBD reporting periods [20m, 30m, 1h, 2h, 3h, 4h, 6h, 12h, 1d]. For example: an ID of 0 would indicate a 20m SBD reporting period, an ID of 5 would mean a 12h SBD reporting period, etc.

The microSpider2 log period ID is a 4-bit number index of microSpider2 log periods [5m, 10m, 15m, 20m, 30m, 1h, 2h, 3h, 4h, 6h, 12h, 1d]. For example: an ID of 1 would mean a logging period of 10m, an ID of 8 would mean a logging period of 4h, etc.

The record count ID is a 4-bit number index of the number of records included for the given channel in the current report, with count values of [0, 1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 72, 96]. For example: an ID of 0 would mean the channel isn't included in this report (0 records), an ID of 3 would mean there are 3 records of this channel in this report, an ID of 8 would mean there are 12 records of this channel in this report, etc.

#### Data (repeated for each channel reading):

FIELD	SIZE (bytes)	CODING	COMMENT
Channel value record	Type 12: 4 Type 13: 3	Type 12: float Type 13: special	Type 12 is coded in standard 32-bit IEEE floating point format. Type 13 is specially coded similar to a 32-bit IEEE floating point number but with differing field lengths to make it only 24-bits: 1-bit sign, 5-bit exponent with bias of 10, 18-bit mantissa.

The historical channel records are ordered in decreasing order (most recent record first).

The channel value record may also be a special information record. Information records are used to further reduce the number of bytes that need to be sent over SBD in the event that records are not available for reporting. When a record value's exponent and highest bit of the mantissa are all 1s (i.e.: value is a type of NaN as defined in the IEEE floating point standard), the least significant 2 bytes (named 1 and 0) contain information for the decoder rather than a channel value. The available information record types are given below:

- If byte 1 is 03 or byte 1 is FF
  - If byte 0 is FF: 1 record is being skipped, continue processing this channel
  - Otherwise: byte 0 specifies the number of records being skipped, continue processing this channel
- Otherwise if byte 1 is 02
  - If byte 0 is FF: 1 record is being skipped and this is the last record for this channel (move on to processing the next channel)
  - Otherwise: byte 0 specifies the number of records being skipped, and this is the last record for this channel (move on to processing the next channel)

Example information records in 3-byte float mode (report format type 13):

Record	Info code (byte 1)	Operand (byte 0)	Comment
0x7F0304	0x03	0x04	skip 4 records, continue processing
0xFFFFFFFF	0xFF	0xFF	skip 1 record, continue processing
0xFF0202	0x02	0x02	skip 2 record, end of channel
0x7F0200	0x02	0x00	end of channel (no records skipped)

Example information records in 4-byte float mode (report format type 12):

Record	Info code (byte 1)	Operand (byte 0)	Comment
0x7FC0304	0x03	0x04	skip 4 record, continue processing
0xFFFFFFFF	0xFF	0xFF	skip 1 record, continue processing
0xFFFF0202	0x02	0x02	skip 2 record, end of channel
0x7FC00200	0x02	0x00	end of channel (no records skipped)

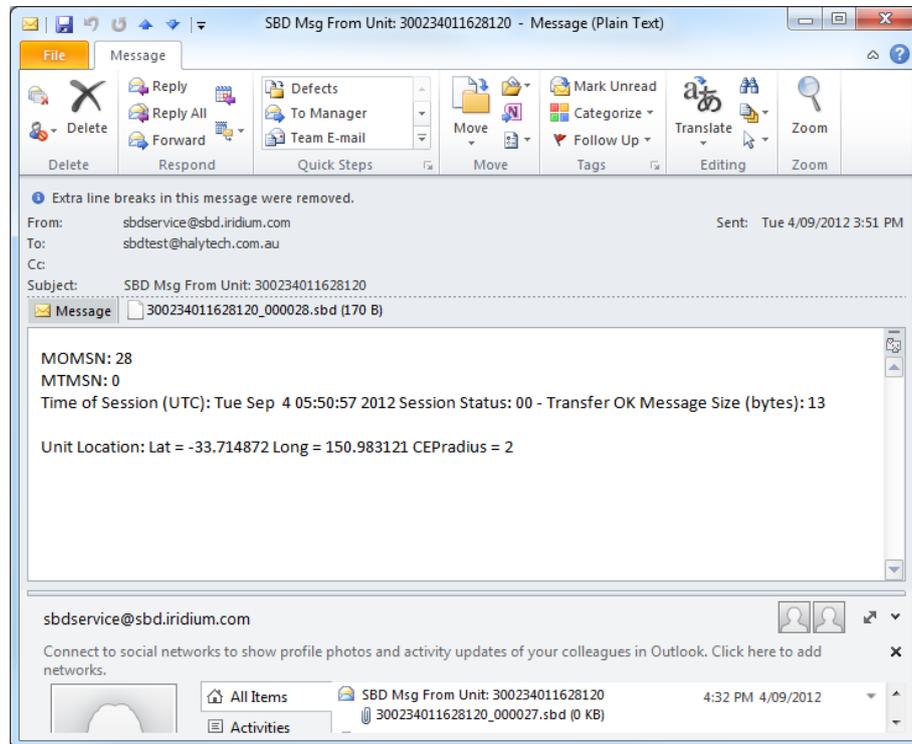
### Type 0

This is a response report format sent in reply to commands issued to the unit. The message contains the report type, first two characters of the Location Name, current time, the number of variables successfully processed and the total number of variables found, whether successfully processed or not.

FIELD	SIZE (bytes)	CODING	COMMENT
Message type	1	none	Set to 0 in this type
microSpider2 ID	2	none	First 2 characters of microSpider Location Name
Date / time	4	long int	Time in seconds since 00:00:00 1/1/1970
Processed variables	1	none	Successfully processed variables
Total Variables	1	none	Total number of variables found

## Sample SBD Email

All SBD messages (reports) sent by the microSpider2 Satellite will arrive as an attachment to an email. A sample email is shown below:



As shown above, this sample email contains the following information:

- a unique modem number, or IMEI (in the sample: 300234011628120) which can be used to differentiate messages from multiple different microSpider2 Satellite units
- the approximate longitude/latitude coordinates of the device which sent the message
- the time/date the message was sent
- The SBD message data itself as an attachment

## Sending Commands to the microSpider

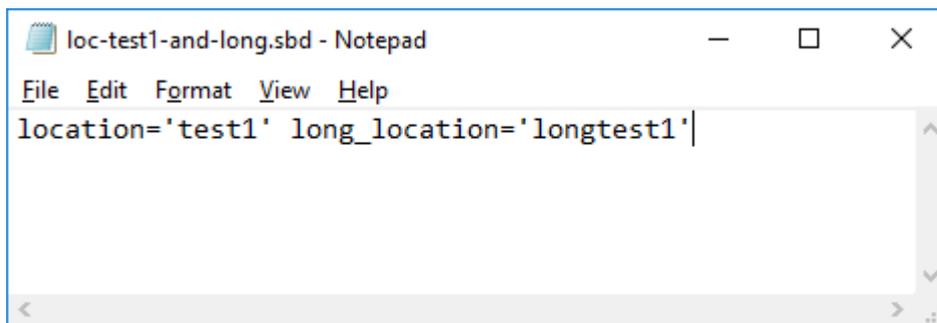
It is possible to send commands to the microSpider via email to the Iridium system to update the configuration of the device.

To send a command to the unit create a text document in Notepad, or similar, containing the variable/s to update. The format is

```
key1='value1' key2='value2'
```

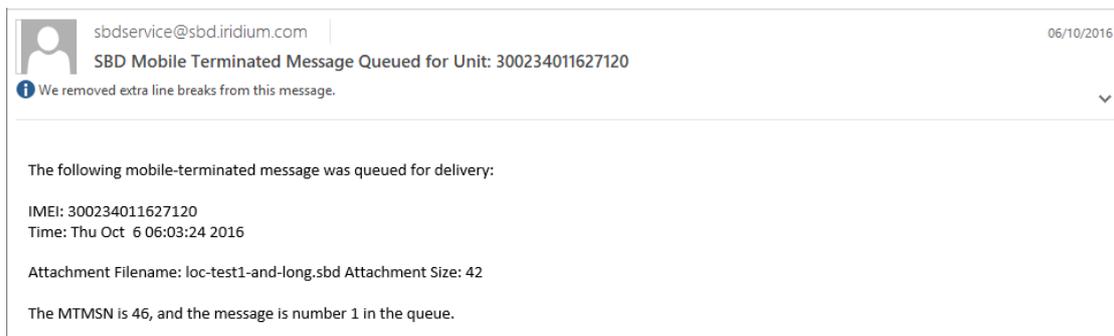
Where the keys are the variable to update, the SMS commands can be used with the exceptions are any commands that initiate reports and any commands that are not associated with satellite units e.g. email, FTP, NTP, etc.

The extension of the text file must be changed from **.txt** to **.sbd**, the filename can be anything up to 76 characters.



Send the file as an attachment to [data@sbd.iridium.com](mailto:data@sbd.iridium.com) with the unit's IMEI as the Subject of the email.

After sending the email you should receive a reply from Iridium indicating the message has been successfully queued for delivery. The unit will pick up this message the next time it sends in a scheduled report.



When the unit receives the message it will process the commands and respond with a report type 0 indicating whether it has been successful.

## microSpider2 Satellite Setup Steps

The microSpider2 Satellite should first be set up by following the '*Setting up the microSpider2 for the first time*' section in the microSpider2 Environmental/Industrial manual. Keep in mind that a number of features relating to WAN and Mobile Internet (including FTP, Email, NTP, Twitter, and Automatic Updates) are not available in the microSpider2 Satellite, and so descriptions of these features in the microSpider2 Environmental/Industrial manual can be skipped over.

The next step is to decide on the kind of data you would like to receive from the microSpider2, as well as how often this data should be sent. The settings controlling these options can be found in the Report Settings page (Change Setup -> Reports). Report format types are described in further detail in the *Report Format Types (Overview)* section of this document (page 11), and the available options are outlined in *Reports* on page 9.

Once these options have been set, the next step is to set which channels are to be included in the report and, if a history-capable report format type has been selected, the period at which readings from these channels should occur in the reports. This is done on the Input Setup page (Change Setup -> Inputs) through the 'Include in SBD report' checkbox and the 'SBD Spacing' option, as described in the *Input Setup* section of this document (page 10).

