Introduction

It is possible to connect a Sarian cellular router to a Pharos LPC to enable the LPC to send and receive SMS text messages. This allows for both remote triggering and status reporting via SMS messaging.

Possible applications include:

- Triggering of timelines by members of the public sending SMS text messages.
- Administrative control (such as rebooting) by SMS from authorised telephone numbers.
- Reporting 'system running' on a daily or weekly basis.
- Reporting error conditions (such as security breaches, environmental conditions or external equipment failure) using sensors connected to the LPC.

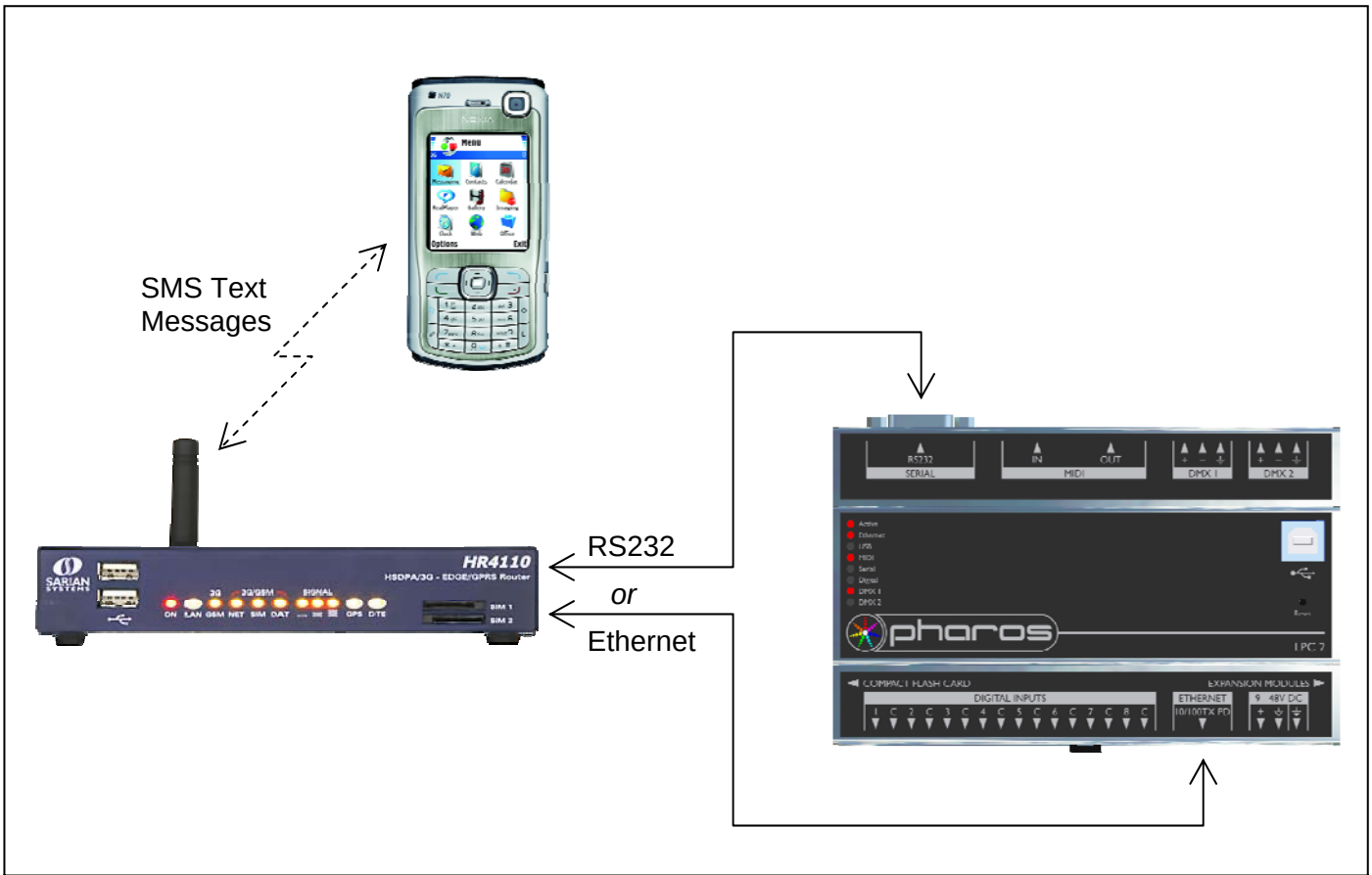


Figure 1: Sending and receiving messages using a Pharos LPC and Sarian cellular router.

Hardware Requirements

The following items will be required:

LPC

A single LPC 1 or LPC 2 is required. Either the serial port or the ethernet port may be used to connect to the Sarian router.

Sarian Router

At the time of writing, a number of different cellular routers are available from Sarian. Each router is differentiated by the number of cellular protocols supported (GPRS, EDGE, UMTS (3G) and HSDPA) and the number of ethernet and serial ports.

The following procedure has been tested with an HR4110 router featuring GPRS/EDGE/UMTS (3G)/HSDPA, one serial port and one ethernet port. It is believed that other Sarian routers should also be compatible, but this has not been tested.

SIM Card

A suitable SIM card must be installed in the router. If the sole aim is to send and receive SMS text messages, any standard SIM and tariff will suffice. If there is also a requirement to use the router to provide a connection to the internet, the SIM may need to be set up by the network operator to provide this functionality.

In some circumstances, it may be desirable to use a ‘pre-paid’ SIM card to limit the maximum expenditure, should the LPC send a large number of SMS text messages.

Ethernet Switch

During programming, it is advisable to connect the Sarian router, the LPC and a computer on the same network. If necessary, this switch can later be replaced with a crossover cable between the router and the LPC, but it is strongly advised to use a switch to facilitate easy access should further programming be required.

Once installed, the Sarian router and the LPC may be connected by a serial cable instead of via ethernet if desired.

Functional Overview

Before starting an installation, it is useful to understand how the system will operate when completed.

Sarian Routers can be loaded with firmware that enables them to run ScriptBasic scripts. These scripts are relatively simple computer programs that can extend the router's standard functionality as required for different applications.

Pharos Architectural Controls has written a script dedicated to interfacing the router to an LPC for the purpose of sending and receiving SMS text messages. This script is available on request from Pharos technical support. The script must be loaded onto the Sarian router and configured with the necessary information to enable it to contact the LPC. Communication may be either network-based, or using a serial cable.

Once the initial configuration of the router has been completed, sending and receiving SMS text messages is as simple as setting up triggers in the show running on the LPC.

Incoming SMS text messages will be sent to the LPC as a text string which includes the message text and the source phone number. An RS232 Input trigger or Ethernet Input trigger in the show running on the LPC can match against all or part of this string and perform the required action.

Triggers in the show may also be set up to send SMS text messages by adding an RS232 Output action or an Ethernet Output action to send a command to the Sarian router which includes the destination phone number and the message text.

Installation

Testing the Sarian Router

If the router has not previously been used, it is advisable to verify it is operating correctly before attempting to update the firmware.

- Install and run the 'Sarian Connection Wizard' (from the CD that accompanies the router).

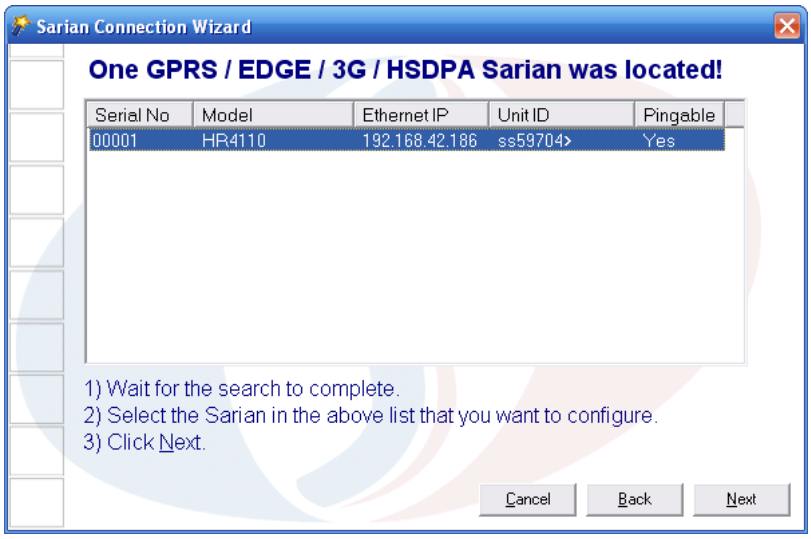
- Select the second option ("Configure a Sarian's Ethernet port and also a connection to a GPRS / EDGE / 3G / HSDPA network") and click Next.
- Follow the instructions displayed by the wizard to connect up the router:

Sarian Connection Wizard
Connect the Ethernet cable
DC IN
DTE
AERIAL
EXP.
Connect the Ethernet cable to the port labelled "LAN" or "LAN 0" on the rear of the Sarian.The other end of the Ethernet cable must be plugged into a hub or switch to which your PC is also connected.
Cancel
Back
Next

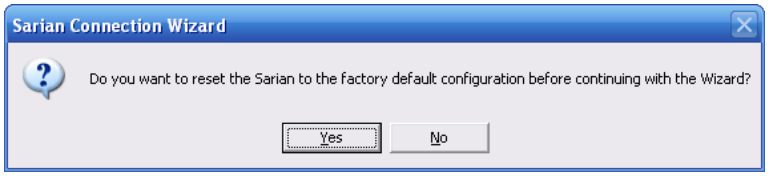
Sarian Connection Wizard
Connect the Aerial
DC IN
DTE
AERIAL
EXP.
1) Connect the Aerial to the port labelled Aerial, GPRS, Edge or 3G.
2) Click Next.
Cancel
Back
Next

Sarian Connection Wizard
Connect the PSU
DC IN
DTE
AERIAL
EXP.
1) Connect the power adaptor to the port labelled DC.
2) Plug the power adaptor into the mains supply.
3) Wait for the GSM LED to start flashing if there is one.
4) Click Next.
Cancel
Back
Next

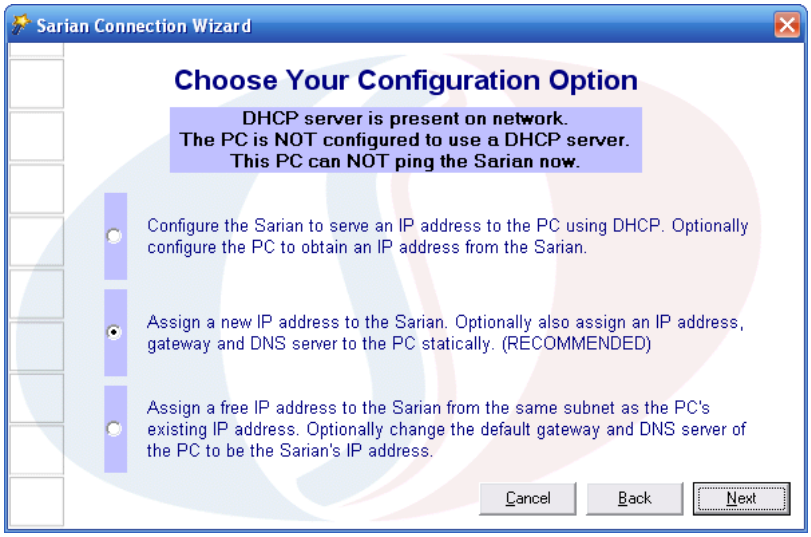
- Confirm the router has been detected:



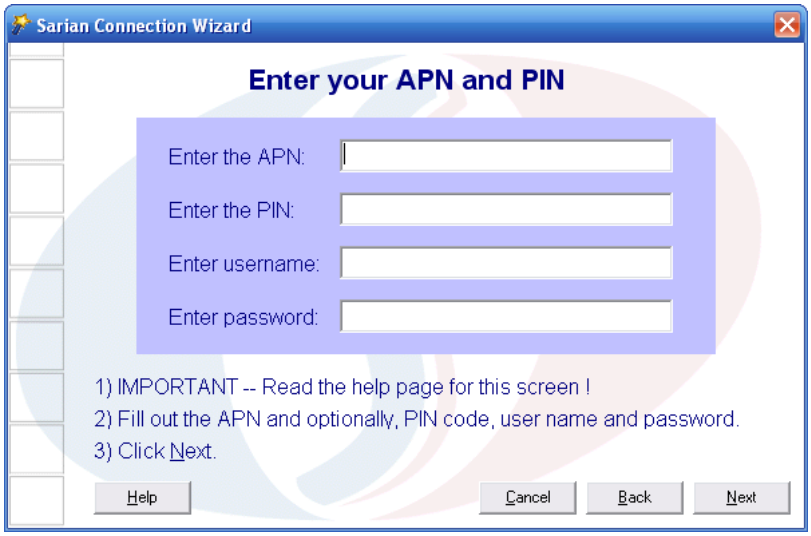
- Select the router and click Next.



- Click 'Yes' to reset the router to the factory default configuration. It may take a short time for this to complete and for the router to reboot.

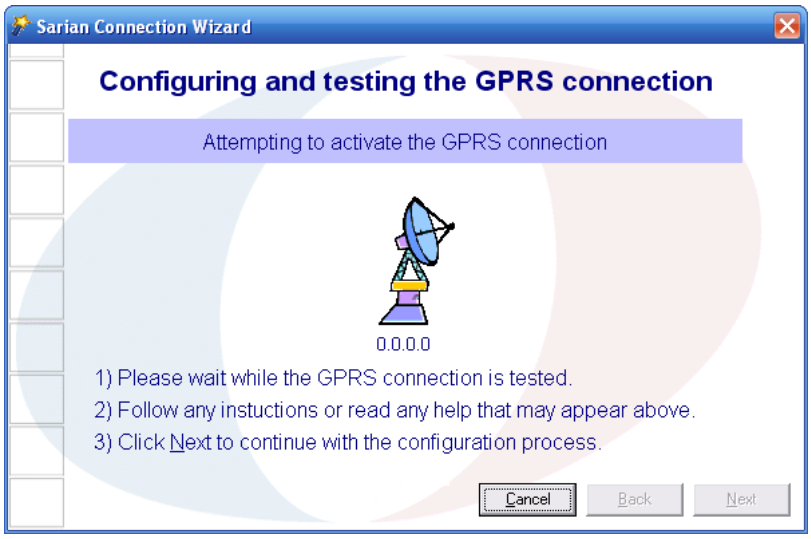


- Select the option 'Assign a new IP address to the Sarian'. (This may or may not be the recommended option, depending on your network configuration.)

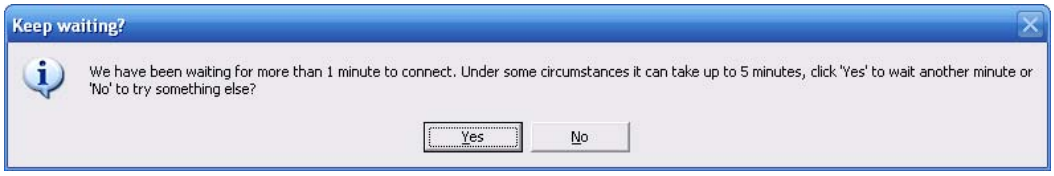


- If you only wish to use the router to send and receive SMS text messages:
  - Leave the APN, username and password fields blank.
  - If the SIM card has a PIN code set, enter it here.
  - Click ‘Next’.
- If you also wish to use the router for internet access (for example, for email and web access while working on-site, or to allow the LPC to connect to an external time server):
  - NOTE: Before entering the following information, it is strongly recommended you contact your network operator to determine what charges will be levied for internet access. Some operators offer ‘unlimited access’ data tariffs for a monthly fee, while others only offer ‘per megabyte’ data tariffs. The cost of these tariffs can range from fairly reasonable to extortionate, so make absolutely sure you understand the charges that are applicable to your tariff before proceeding. If unsure, do not enter the following information. You will still be able to send and receive SMS text messages if you leave the APN, username and password fields blank.
  - Enter the APN, username and password for your internet connection. This information will be available from your network operator. Further information is available by clicking the ‘Help’ button. Alternatively, a list of common APN, username and password settings for networks around the world can be found at http://www.taniwha.org.uk/gprs.html
  - If the SIM card has a PIN code set, enter it here.
  - Click ‘Next’.

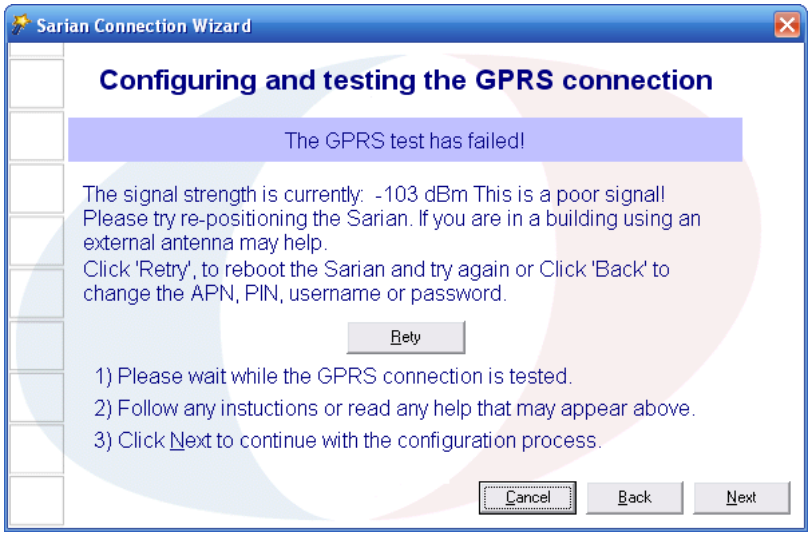
- The router will now attempt to connect to the internet:

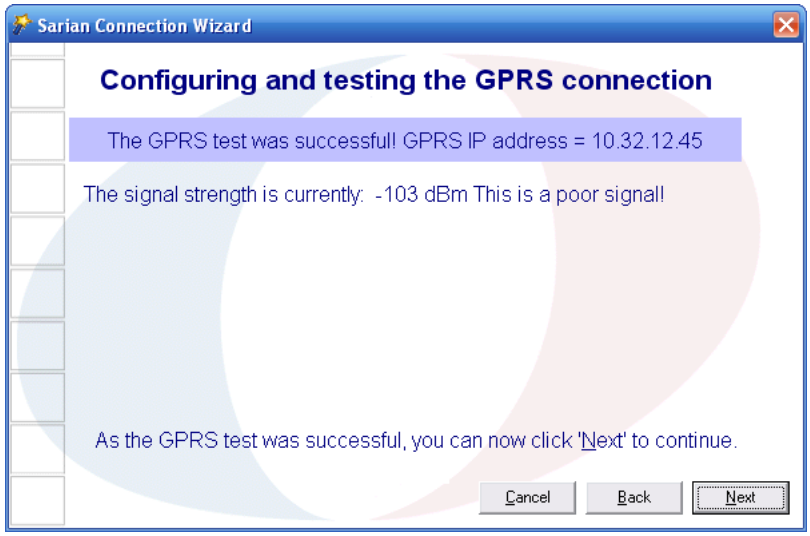


- It may take more than 1 minute to connect to the internet. In this case, the following message will be displayed:

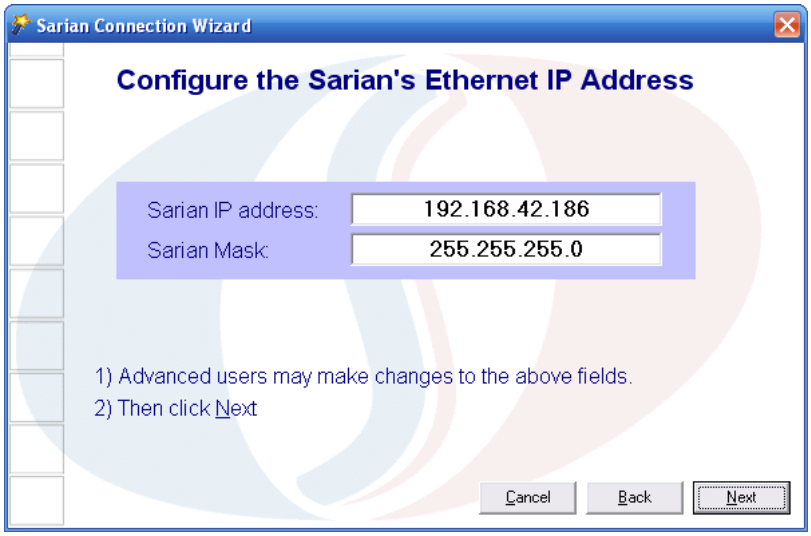


- If you have entered an APN, click ‘Yes’ to wait for another minute. If you have not entered an APN, click ‘No’ (as the test will never succeed).
- Depending on whether the router is able to connect to the internet, the wizard will display one of the following screens:

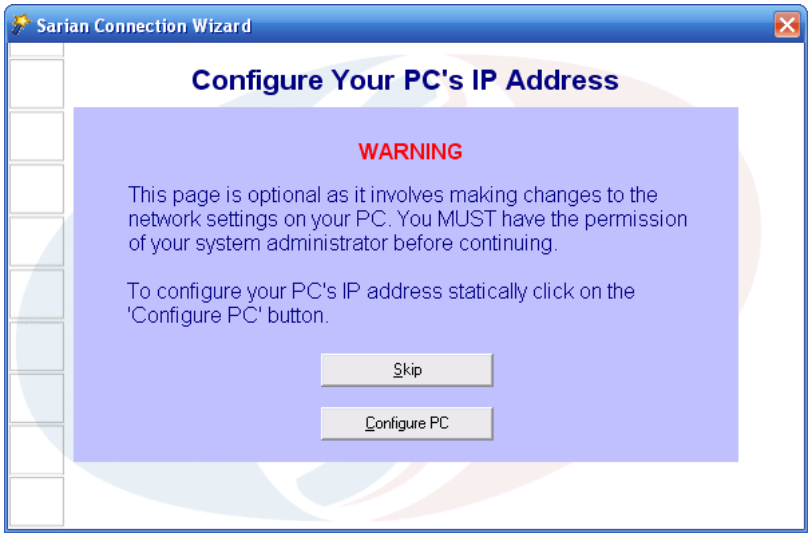




- If the test fails, you will still be able to send and receive SMS text messages, but the router will not be able to connect to the internet.
- Click Next.

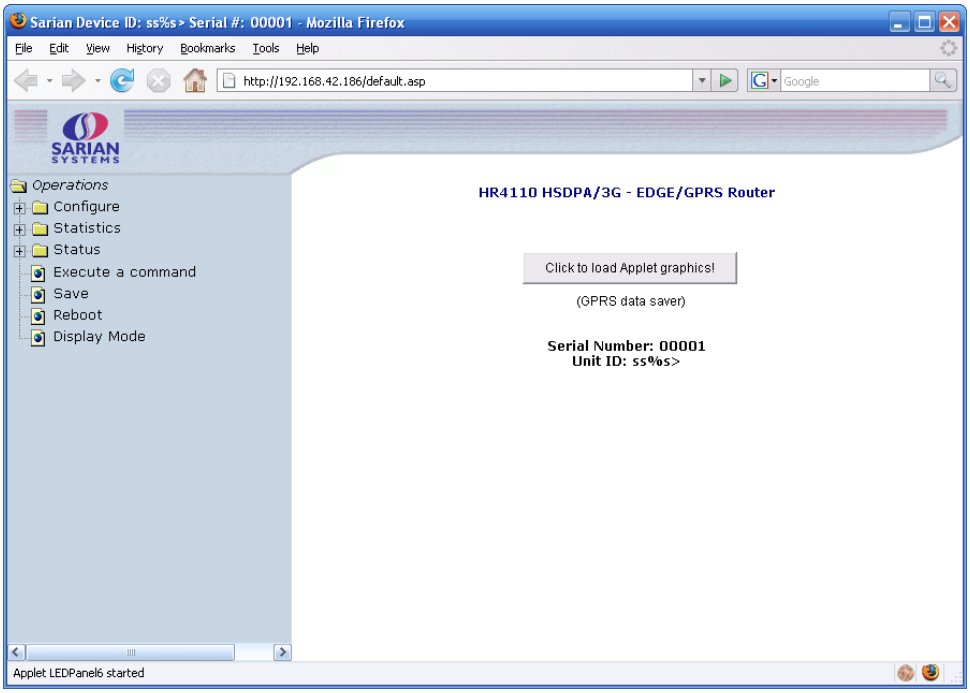


- Enter the desired IP address and network mask for the router. (The router, LPC and PC should all be on the same network.) Make a note of the IP address as it will be required later.

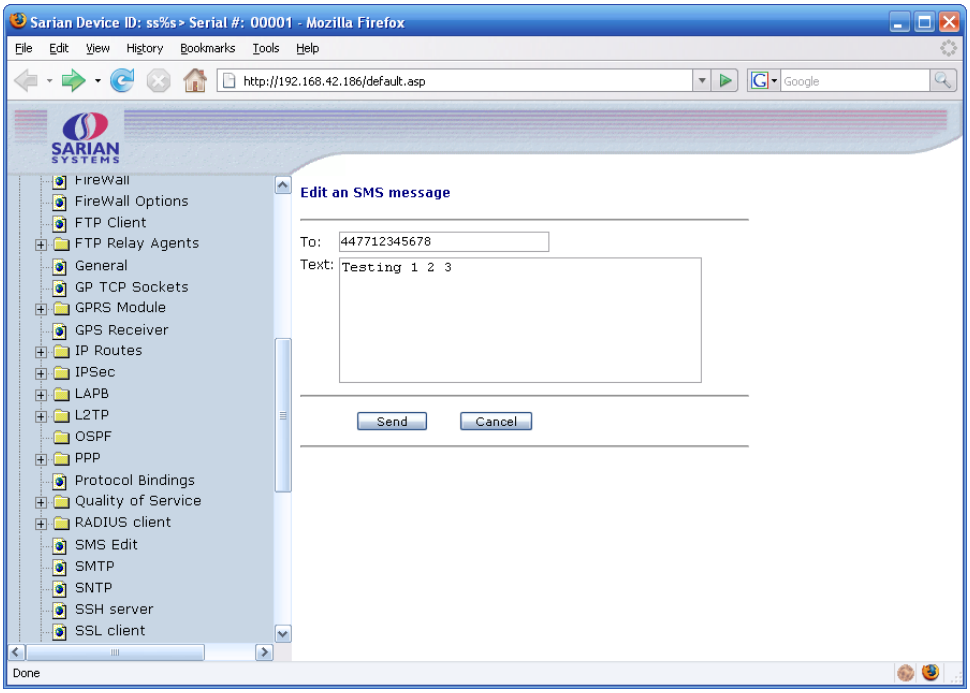


- Click ‘Skip’ to leave the PC’s IP address unchanged.

- Click the ‘Browse Sarian’ button.



- Confirm the router’s web interface loads and displays correctly. (If asked for login details, the defaults are ‘username’ and ‘password’.)
- Select *Operations : Configure : SMS Edit*.



- Enter a test message and a suitable phone number, including the country dialling code prefix, and click Send. Confirm the message is sent and received correctly.

  Note: Phone numbers **must** include the country dialling code prefix. The local dialling format (which does not include the country dialling code prefix) will not work, even if the router is in the same country as the phone to which the SMS text message is being sent. For example:

447712345678	Correct – Includes UK country dialling code of '44'.
07712345678	Incorrect – No country dialling code specified.

- If the SMS test fails, it may be necessary to enter an SMS message centre number (available from your network operator). This can be set under *Configure : GPRS Module : SIM 1* in the 'SMS message centre' field.

Updating the Sarian Router's Firmware

Before the router can be used with an LPC, it is necessary to update the router's firmware to add support for ScriptBasic.

The 'Sarian Connection Wizard' and 'FlashWriter' programs will be required. The 'Sarian Connection Wizard' is supplied on the CD that accompanies the router, while 'FlashWriter' can be downloaded from the Sarian website.

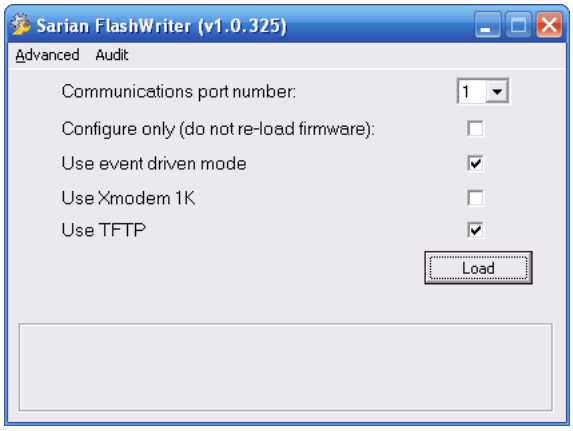
- Download the latest version of firmware with support for ScriptBasic.

  At the time of writing, firmware updates can be downloaded from http://www.sarian.co.uk/flashwriter.htm.

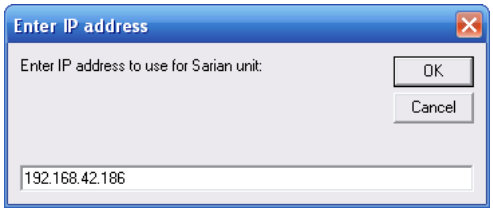
  When downloading firmware from the Sarian website:

  - Carefully read the instructions regarding FlashWriter and downloading firmware. If discrepancies exist between instructions on the Sarian website and instructions in this document, follow the instructions from the Sarian website.
  - Ensure the filename exactly matches the router model number.
    Eg. Firmware files for the HR4110 router **must** start with HR4110, or the router will be damaged.
  - Select the latest build of firmware (indicated by a number in the filename) that has ScriptBasic support enabled (indicated by '+Basic' in the filename).
- Extract both the .all and the .ini files from the downloaded zip file to a new directory.
- Connect the router to a spare serial port on the PC.
- Run the FlashWriter application.

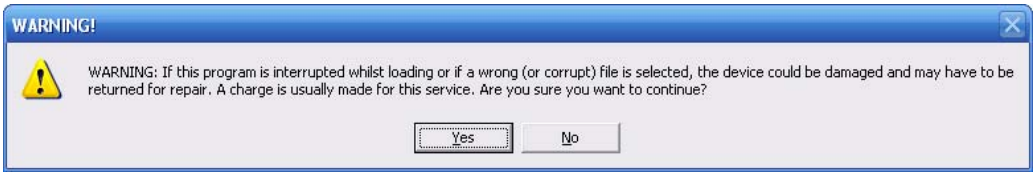
- Read the message and click 'OK'.



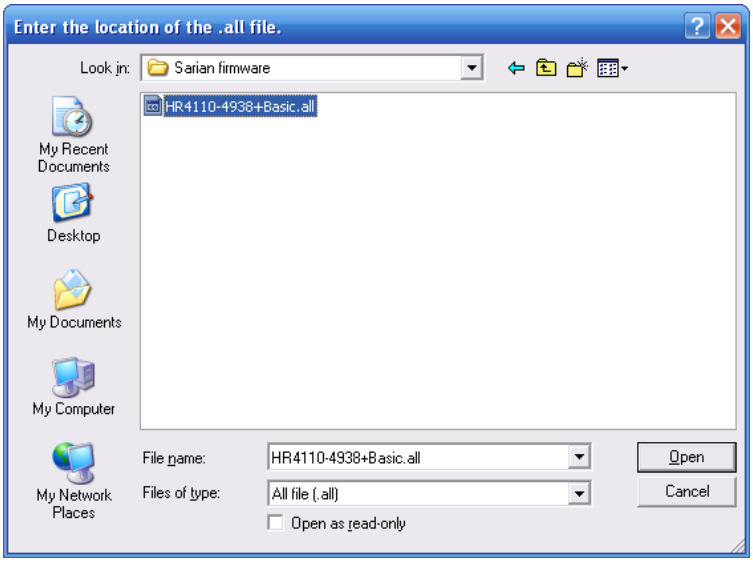
- Select 'Advanced', 'Set remote TFTP IP address'.



- Enter the Sarian's IP address and click 'OK'.
- Click the 'Load' button.

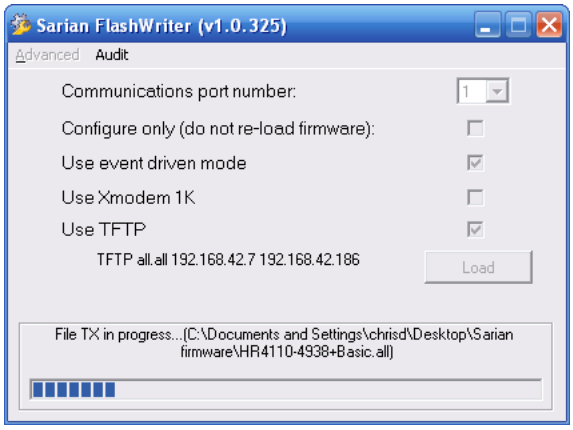


- Read the warning and click 'Yes'.

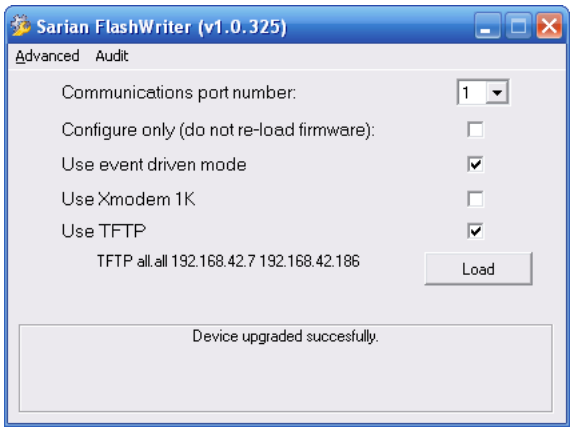


- Select the .all file that was extracted from the downloaded zip file.

- Switch off the router, click OK and then immediately switch the router on.



- The firmware upgrade will start. This may take a few minutes.



- Wait until FlashWriter reports 'Device upgraded successfully'.
- Close FlashWriter.
- Re-run the Sarian Connection Wizard.

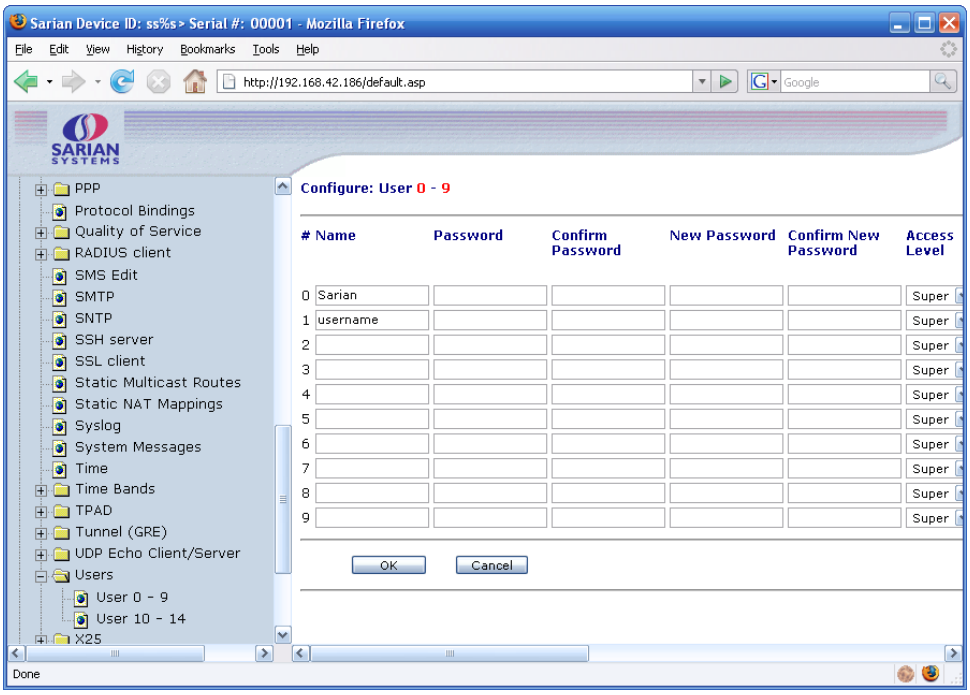
  Uploading new firmware resets some of the configuration options, such as IP address. Therefore, it is necessary to re-run the Sarian Connection Wizard to correctly configure the router. The correct procedure is listed above in the 'Testing the Sarian Router' section.

  The SMS sending test should be repeated to confirm the unit is still operating correctly with the ScriptBasic firmware.

Configuring the Sarian Router's Security Settings

The router should be configured to ensure it is protected against unauthorised access:

- Display the router's web interface and log in. (The defaults are 'username' and 'password'.)
- Select *Operations : Configure : Users : User 0 – 9*



- Delete the existing users, enter a new username and password and click OK. Make a note of the username and password as they will be required later.
- Click 'save to flash'.
- Select '0 (power up)' and click OK.

Uploading the Script to the Router

The 'pharos.sb' script (available from Pharos technical support) must be uploaded to the router via FTP.

To perform this upload on windows:

- Open a Windows Explorer window.
- Type '`ftp://192.168.0.10`' into the address bar (substituting the correct IP address for the router) and press enter.
- When prompted, enter the login details you set earlier.
- Drag and drop the `pharos.sb` file from your hard disk into the FTP window and wait for the copy to complete.
- Close the Explorer window.

Configuring the Router's SMS Options

The Sarian router must be configured using the web interface as follows:

- Open a web browser and enter the router's IP address.
- When prompted, enter the login details you set earlier.
- Set the following configuration options:

  Operations : Configure : GPRS Module : SIM 1

  Set the 'SMS message centre' number (available from your network operator).

  Set the 'SMS polling interval' to '0'.

  Confirm the 'SMS command caller ID' entries are all blank.

  Click 'OK'.

  Operations : Configure : Event Handler

  Set the 'Max SMS/day' to the desired maximum number of messages that should be sent in a day. This is a protection against programming errors to ensure the system does not run up a large bill by sending too many SMS text messages.

  Click 'OK'.

Operations : Configure : Basic

Set the 'User parameter 1' as follows:

If using a serial connection between the LPC and router, enter:

```
PHAROS: COMMS=SERIAL
```

If using an ethernet connection between the LPC and router, enter:

```
PHAROS: COMMS=NETWORK, LPC_IP=192.168.0.5, LPC_PORT=5000, ROUTER_PORT=5000
```

(Substitute the correct IP address for the LPC.)

If necessary, you may change the `LPC_PORT` and `ROUTER_PORT` options to other values to suit your network environment. In most cases however, the above will work.

Click 'OK'.

Note: These options may be changed at any time and will take immediate effect. It is not necessary to reboot the router, although it is necessary to save any changes (see below).

Operations : Configure : General

Set the 'Auto start macro' to '`bas pharos.sb`'.

Click 'OK'.

Operations : Save

Select '0 (power up)' and click 'OK'.

Wait for confirmation that the configuration has been saved successfully.

Operations : Reboot

Click 'REBOOT' and wait for the system to restart.

- Once the system has restarted, log in again and re-visit the above pages to confirm the configuration options have successfully been stored.
- Select *Operations : Status : Event Log* and confirm the log contains the messages similar to the following (which may not be at the top):

```
PHAROS: Listening for commands on port 5000.
PHAROS: Received text messages will be sent to 192.168.0.5
PHAROS: Pharos script starting up...
```

If any error messages are displayed, re-check the configuration options above.

Configuring the Communication Method

The project to be used with the LPC must be set up within Pharos Designer as follows:

If the LPC and router are to communicate via ethernet:

- In Designer, display the Network tab and select the desired LPC.
- On the 'Controller Properties' pane, set the Ethernet options for Bus 1 as follows:

  Type: TCP
  Port: 5000 (to match the LPC_PORT configuration set on the router).

Alternatively, if the LPC and router are connected by a serial cable:

- In Designer, display the Network tab and select the desired LPC.
- On the 'Controller Properties' pane, set the Serial Port options as follows:

  Baud Rate: 38400
  Data Bits: 8
  Stop Bits: 1
  Parity: None

Creating a Trigger to Receive SMS Text Messages

When the Sarian router receives an SMS text message, a string is sent from the router to the LPC is in the following format:

```
SMSFROM:[number]SMSTEXT:[message]\r\n
```

`[number]` is the phone number from which the message was sent, including the country dialling code. It has a fixed length of 20 characters. Numbers shorter than 20 characters are padded with spaces.

`[message]` is the contents of the received message, converted to upper case.

The `\r\n` is a 'new line' sequence, which indicates the end of the message.

For example, a message of 'Hello, world!' sent from telephone number 07712345678 in the UK (country dialling code 44) would produce the string:

```
SMSFROM:447712345678          SMSTEXT:HELLO, WORLD!\r\n
```

If it is desired to only respond to messages from a single telephone number, the trigger should use the full string (including both SMSFROM and SMSTEXT parts). The correct number of 'space' characters must be inserted between the telephone number and 'SMSTEXT' to ensure that the total length of the telephone number and the spaces is 20 characters.

If it is desired to respond to messages from any telephone number, only the SMSTEXT part of the string should be matched against. For example:

```
SMSTEXT:RED\r\n
```

As messages are converted to upper case, the above string will match to messages "red", "RED" and "Red", amongst others.

The `\r\n` may be omitted from the string to match for if it is desired to match to all incoming messages that start with a specific word. For example:

```
SMSTEXT:RED
```

This will match to messages "Red", "Red On" and "Reduce", amongst others.

Once the desired string to match to has been determined, it should be entered as part of a trigger using Pharos Designer, as follows:

If the LPC and router are to communicate via ethernet:

- In Designer, display the Triggers tab.
- Create a new Ethernet Input trigger with the following options:

  Absorb on match: Yes
  Source: Bus 1
  Message Type: ASCII
  Message: `SMSTEXT:RED\r\n`

Alternatively, if the LPC and router are connected by a serial cable:

- In Designer, display the Triggers tab.
- Create a new RS232 Input trigger with the following options:

  Absorb on match: Yes
  String Type: ASCII
  String: `SMSTEXT:RED\r\n`

Creating an Action to Send an SMS Text Message

To send a message, a string must be sent from the LPC to the Sarian router in the following format:

```
SENDSMS [number] [message]\r\n
```

`[number]` is the phone number to which the message should be sent, including the country dialling code. It may be any length (padding is not required).

`[message]` is the contents of the message to send.

The `\r\n` is a 'new line' sequence, which indicates the end of the message.

For example, to send a message of 'System running.' to telephone number 07712345678 in the UK (country dialling code 44), the following string is required:

```
SENDSMS 447712345678 System running.\r\n
```

This string should be entered as part of an Action, as follows:

If the LPC and router are to communicate via ethernet:

- In Designer, display the Triggers tab and select the desired trigger.
- Create a new Ethernet Output action with the following options:

  Controller: 1
  IP Address: (the correct IP address for the Sarian router)
  Port: 5000 (to match the `ROUTER_PORT` set on the router).
  Protocol: TCP
  Message Type: ASCII
  Message: `SENDSMS 447712345678 System running.\r\n`

Alternatively, if the LPC and router are connected by a serial cable:

- In Designer, display the Triggers tab and select the desired trigger.
- Create a new RS232 Output action with the following options:

  Controller: 1
  String Type: ASCII
  String: `SENDSMS 447712345678 System running.\r\n`

Quick Reference

Sample script configuration options:

```
PHAROS: COMMS=NETWORK, LPC_IP=192.168.0.5, LPC_PORT=5000, ROUTER_PORT=5000
```

Network comms: TCP on ports specified by configuration options.

Serial comms: 38400, 8, N, 1 (must set `COMMS=SERIAL`)

To verify communication: Send '`ping\r\n`'. A response of '`PONG`' should be received.

Sample incoming message string:

```
SMSFROM:447712345678        SMSTEXT:HELLO, WORLD!\r\n
```

(20 characters for number and padding, message converted to upper case.)

Sample outgoing message string:

```
SENDSMS 447712345678 System running.\r\n
```