



# **BaseStation**

## ***SBS-3***

***SBS-1eR, SBS-1e, SBS-1,***

***1090 Puck, SDR Puck***

# **Reference Manual**

**Revision 3.2.2**  
**12 December 2013**

## CHANGE RECORD

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# 1 Overview




## 1.1 Introduction

This manual is a reference guide to the BaseStation application for the SBS-3. It can also be used with the 1090 Puck, SDR Puck, SBS-1eR, SBS-1e and SBS-1.

BaseStation is a Windows application written originally for the SBS-1 family of Virtual Radar Receivers. The latest version (1.2.4.183) of BaseStation has been updated for the SBS-3 and the Puck but may also be used with the SBS-1eR, SBS-1e and the classic SBS-1, although not all features will apply. Features that do not apply to all products are marked in this manual with the symbols **SBS-3**, **SBS-1eR**, **SBS-1e**, **SBS-1**, **1090 Puck** and **SDR Puck** as appropriate.

Please note that it may also be necessary to upgrade the firmware when upgrading to the latest version of BaseStation.

## 1.2 Document Conventions

-  A paragraph with this symbol contains a handy tip that will help you use the product more efficiently.
-  A paragraph with this symbol contains an important point that you need to understand.
-  A paragraph with this symbol warns you about possible problems you might encounter.

## 1.3 Product Descriptions

The SBS-3 is a Virtual Radar Receiver with two built-in Software Defined Radio (SDR) tuners allowing up to six VHF or UHF radio channels to be monitored simultaneously, for voice or data. It can be connected to a PC or network using USB or Ethernet.

The 1090 Puck is a compact, lightweight Virtual Radar Receiver with similar performance to the SBS-3 but without the SDR tuners and connects to a PC using USB only.

The SDR Puck is a compact, lightweight Software Defined Radio (SDR) tuner allowing up to six VHF or UHF radio channels to be monitored simultaneously, for voice or data.

## 1.4 Further Information

A useful source of further information can be found at the SBS Forum:

[www.kinetic.co.uk/forums](http://www.kinetic.co.uk/forums)

Accessories may be purchased from:

[www.taylormaderf.co.uk](http://www.taylormaderf.co.uk)

Software and firmware updates are available at:

<http://www.kinetic.co.uk/basestationdownloads1.php>




## 2 Getting Started

### 2.1 Connecting using USB (except SDR Puck)

The simplest way to get started with your 1090 Puck, SBS-3, SBS-1eR, SBS-1e or SBS-1 is to connect it to your PC using a USB cable, attach the 1090 MHz antenna, and install the BaseStation software following the procedure described in the *Getting Started* notes that accompany the BaseStation CD-ROM.

Running the BaseStation installer will also automatically install the FTDI USB driver that BaseStation needs to communicate to the 1090 Puck, SBS-3, SBS-1eR, SBS-1e or SBS-1 using USB. When the install process is complete, run the BaseStation application. The first time that you run BaseStation it will ask you to input your home location and will check that data is received correctly from the SBS unit.

The *BaseStation Software Reference* section of this manual describes how to view aircraft on a Virtual Radar Display.

 The SBS-3 may require over 1000 mA of current from the USB port when both SDR tuners are turned on. Some PC's, particularly older ones may not be able to supply this amount of power on a USB port. In this case, a special Y cable may be used to connect to either a second USB port on the PC, or an external power supply. One arm of the Y cable carries power only, and the other carries both power and data.

When receiving 1090 MHz radar data only, the SBS-3 uses less power and can be powered from any USB port.

### 2.2 Connecting an SDR Puck using USB

Connect your SDR Puck to your PC using a USB cable, and install the BaseStation software following the procedure described in the *Getting Started* notes that accompany the BaseStation CD-ROM.

With an SDR Puck, Basestation is typically used without the main (radar display) window, which may be hidden using the Settings>Hide Main Window menu option. Selecting this option makes the SDR Control Panel the main window of the application, with a limited set of menu items.

Please refer to section 4.1 of this manual for instructions on using the SDR Control Panel.

### 2.2.1 Using an SDR Puck as an Add-on to Virtual Radar

An SDR Puck can also be used in conjunction with an existing 1090 Puck, SBS-1, SBS-1e or SBS-1eR installation, in order to add SDR receiver capabilities to the system. To do this, turn on the *Settings > Add-On SDR Puck* menu item on BaseStation. This menu item should be turned off if the SDR Puck is to be used with an application other than BaseStation.

## 2.3 Connecting using Ethernet

Connecting via Ethernet requires more configuration but can offer greater flexibility, for example allowing connection over long distances.

You can connect using Ethernet if you have an SBS-3, SBS-1eR, SBS-1e or an SBS-1EM add-on Ethernet module for your SBS-1.

To change between USB and Ethernet connection, use the *Settings-Data Source* menu item and select the required type of connection. You may also need to use the *Network* tab of the *Settings-Hardware Settings* menu item to adjust the IP address that BaseStation connects to, if the address of the SBS unit has been changed from the default of 192.168.1.170.

Information on changing the IP address of an SBS-1 family device is available on the SBS forum. See the notes below for the SBS-3.

### 2.3.1 Connecting the **SBS-3** using Ethernet

You will need to refer to the section of this manual on *Configuring SBS-3 Ethernet Settings*.

When connecting via Ethernet you can also use the SBS-3 as a stand alone data server. A remote device can open a TCP socket connection to the SBS-3's main port and receive data without the requirement to log in or run BaseStation. More information is provided in the section on *Stand-Alone Operation of the SBS-3*.









The SBS-3 always needs to be powered using the USB socket. If you are going to connect via Ethernet rather than USB, you will need to attach an external USB power supply. It is recommended that the external supply is rated at 2.0 Amp (2000 mA) or greater. When the USB port on the SBS-3 is connected to a PC (and the orange USB light is on indicating a USB data connection), the Ethernet interface on the SBS-3 is automatically turned off to save power. Therefore you cannot connect using Ethernet if the SBS-3 is connected via a USB cable to a PC.



2.4 **SBS-3** Front Panel LED Indicators Description



LED INDICATORS (viewed from the front – running left to right)

Power	USB OK	Session Active	NVRAM Update	Auxilliary	Ethernet	Tri-Colour	Signal 1 to 4
Indicates SBS-3 is powered	USB port is connected and enumerated	Indicates that BaseStation or other application is connected	The SBS-3 is updating its non-volatile memory	Reserved for future use	BaseStation or other application is connected via Ethernet	Reserved for future use	Bar graph of aircraft activity. Left to Right Orientation.
Red 	Orange 	Green 	Orange 	Red 	Yellow 	TriColour 	Blue Blue Blue Blue 

## 2.5 **SBS-3** Rear Panel Connections



From left to right, the connections at the rear of the SBS-3 are:

**1090 MHz Antenna.** Used to connect the supplied magnetic mount antenna or other 1090 MHz antenna for receiving aircraft radar signals.

**SDR antenna** connection. Used for connecting an antenna for the two built-in SDR receivers.

**Audio out.** A 3.5 mm stereo audio jack socket for use with external speakers or headphones. It may also be connected to the audio line input of a PC or sound card.

**Ethernet.** Used to connect the SBS-3 to a PC or network.

**USB.** Can be used to connect the SBS-3 to a PC or to power the SBS-3 from an external power adapter.

**Aux Connector.** An I2C bus and RS-232 connector for use with future accessories.

## 2.6 **1090 Puck, SDR Puck** Front LED Indicators

LED INDICATORS (viewed from the front – running left to right)

Power	USB OK	Session Active	Aux	Signal 1 to 4
Indicates unit is powered	USB port is connected and enumerated	Indicates that BaseStation or other application is connected	Reserved for future use	Bar graph of aircraft or SDR activity. Left to Right Orientation.
Red ●	Orange ●	Green ●	White ○	Blue Blue Blue Blue ● ● ● ●



## 2.7 **1090 Puck, SDR Puck** Rear Connections












**Antenna.** On the 1090 Puck, used to connect the supplied magnetic mount antenna or other 1090 MHz antenna for receiving aircraft radar signals. On the SDR Puck, used for connecting an antenna for the SDR receiver.

**USB.** Used to connect the Puck to a PC.

## 2.8 **SBS-1eR, SBS-1e** Front Panel LED Indicators













LED INDICATORS (viewed from the front – running left to right)

Power	USB OK	Session Active	NVRAM Update	Reserved	Ethernet	Reserved	Signal 1 to 4			
Indicates unit is powered	USB port is connected and enumerated	Indicates that BaseStation or other application is connected	The SBS unit is updating its non-volatile memory	Reserved for future use	BaseStation or other application is connected via Ethernet	Reserved for future use	Bar graph of aircraft activity. Left to Right Orientation.			
Red 	Orange 	Green 	Orange 	Red 	Yellow 	TriColour 	Blue 	Blue 	Blue 	Blue 

## 2.9 **SBS-1** Front Panel LED Indicators

LED INDICATORS (viewed from the front – running left to right)

Power	USB OK	Session Active	NVRAM Update	Reserved	Reserved	Signal 1 to 4			
Indicates unit is powered	USB port is connected and enumerated	Indicates that BaseStation or other application is connected	The SBS unit is updating its non-volatile memory	Reserved for future use	Reserved for future use	Bar graph of aircraft activity. Left to Right Orientation.			
Red 	Orange 	Green 	Orange 	Red 	Yellow 	Blue 	Blue 	Blue 	Blue 

## 2.10 **SBS-1eR** Rear Panel Connections



From left to right, the connections at the rear of the SBS-1eR are:

**1090 MHz Antenna.** Used to connect the supplied magnetic mount antenna or other 1090 MHz antenna for receiving aircraft radar signals.

**Radio Antenna** connection. Used for connecting an antenna for the built-in air band AM / broadcast FM radio receiver.

**Audio out.** A 3.5 mm stereo audio jack socket for use with external speakers or headphones. It may also be connected to the audio line input of a PC or sound card.

**Ethernet.** Used to connect the SBS-1eR to a PC using a network.

**USB.** Used to connect the SBS-1eR to a PC.

**Power Switch.** Controls whether the SBS-1eR is powered from USB or the external power input.

**External DC Power Input.** 9 to 28V DC (centre pin is +ve).

**External Radio Interface.** An RS-232 connector for controlling an external radio.



## 2.11 **SBS-1e** Rear Panel Connections

From left to right, the connections at the rear of the SBS-1e are:

**1090 MHz Antenna.** Used to connect the supplied magnetic mount antenna or other 1090 MHz antenna for receiving aircraft radar signals.

**Ethernet.** Used to connect the SBS-1e to a PC using a network.

**Ethernet Power Switch.** Controls whether the Ethernet port is powered. The Ethernet port can be switched off when connecting via USB, to save power.

**USB.** Used to connect the SBS-1e to a PC.

**Power Switch.** Controls whether the SBS-1e is powered from USB or the external power input.

**External DC Power Input.** 9 to 18V DC (centre pin is +ve).

**External Radio Interface.** An RS-232 connector for controlling an external radio.

## 2.12 **SBS-1** Rear Panel Connections

**1090 MHz Antenna.** Used to connect the supplied magnetic mount antenna or other 1090 MHz antenna for receiving aircraft radar signals.

**USB.** Used to connect the SBS-1 to a PC.

**Power Switch.** Controls whether the SBS-1 is powered from USB or the external power input.

**External DC Power Input.** Voltage depends on the particular revision of SBS-1 (centre pin is +ve).

**External Radio Interface.** An RS-232 connector for controlling an external radio.

## 3 BaseStation Software Reference

### 3.1 Screen Layout

The main screen of the application looks something like this:

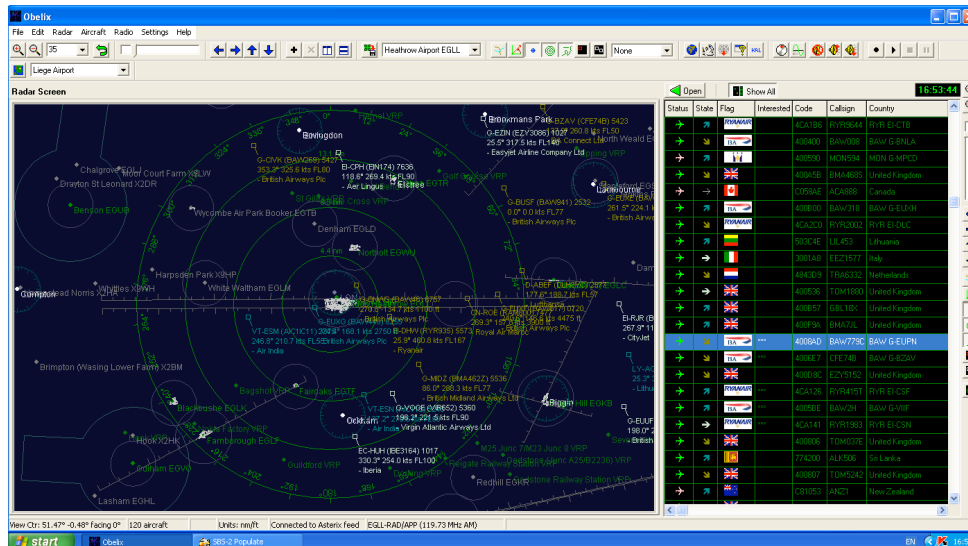


Figure 1: Application main screen

On the left is the Radar Screen and on the right is the Aircraft List. In between them is a splitter control – which you can drag in and out with the mouse to change the width of the Aircraft List.

At the top is the toolbar, which contains shortcut buttons to activate the most frequently used menu items.

Along the right-hand side is the sidebar, which contains shortcut buttons to some menu items related to the radar view. The sidebar is the only part of the user interface that remains visible when in full screen mode.

You can also toggle between a normal and expanded Aircraft List by clicking on the *Aircraft List Expand* button (the button with a green triangle and the caption *Open*).

☞ You can also use the keyboard shortcut Ctrl-E

The picture below shows the screen after the Aircraft List has been expanded:

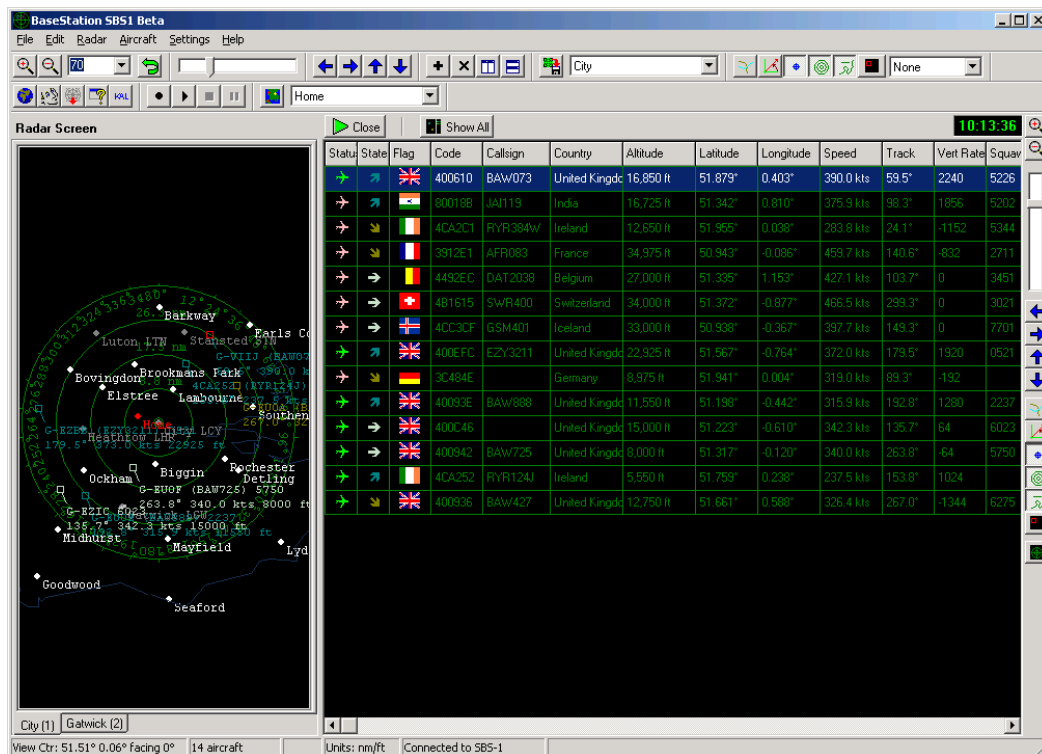


Figure 2: Application main screen with aircraft list expanded

To return the Aircraft List to the normal width, simply click once again on the *Aircraft List Expand* button (the caption on the button will have changed to *Close*).

☞ Keyboard shortcut Ctrl-E



## 3.2 The “Radar” Screen

The radar screen looks something like this:

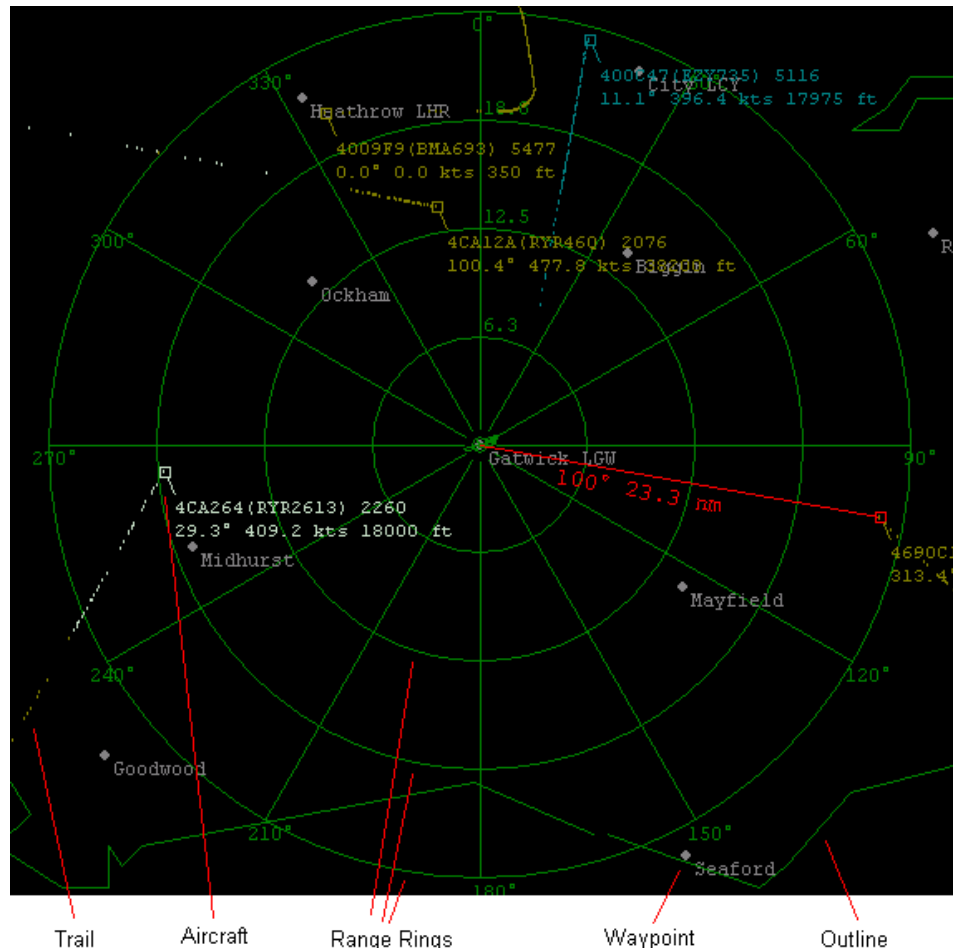


Figure 3: Radar Screen

The above example shows the screen centred on the Gatwick waypoint with a diameter of 50 nautical miles. Five aircraft can be seen on the screen, one of which, 4690C1, is shown as a red box to indicate that it is selected. Since the Display Bearing & Distance option has been enabled for this radar screen, a red line displays the bearing (100 °) and range (23.3 nautical miles) of that aircraft from the centre of the view (Gatwick).

The aircraft, and the trails indicating their past positions, are colour coded to indicate whether they are climbing, descending, or flying level. By default, these colours are:

- Ascending
- Descending
- Level

(The way to remember it is that ascending aircraft are flying towards blue sky, descending aircraft are flying towards brown earth, and aircraft flying straight and level are somewhere in between – hence the blue-green colour).

In our example, 400C47 (top of the screen) has been steadily climbing, 4CA12A (top middle of the screen) was flying straight and level when it entered the screen but is now descending, and 4CA264 (left middle of the screen) was descending when it entered the screen, but is now flying straight and level.

There are two other colours that aircraft can be shown as:



Aircraft that are currently on the ground are shown as grey. If BaseStation does not receive a signal from an aircraft for a set period of time (by default, this is 30 seconds), the colour of that aircraft is changed to yellow. If nothing is received for a further 5 seconds, then the aircraft is removed from the screen.

- ☞ These colours and times can be configured using the *Settings > Display Settings* menu and the *Settings > Data Settings* menu respectively.

## 3.3 Main Menu

This section of the manual describes the function of each menu item available from the application's main menu bar.

☞ Many of these functions are also available via toolbar buttons and/or shortcut keys.

### 3.3.1 File Menu

#### 3.3.1.1 Start Recording

This menu option brings up a box that prompts you for the name of a file to save received data to. The default file name will be *yyyymmdd-hhmmss.bst*, where *yyyymmdd* and *hhmmss* represent the date and time. Once you click on Save, all received aircraft transponder messages will be saved to the file.

☞ Toolbar button  Keyboard shortcut Ctrl-R

#### 3.3.1.2 Play Previous Recording

This menu option brings up a file selection dialog box that allows you to select a .bst file that you previously recorded a session to. The application will then "play" the data in that file, displaying it **instead** of the data being received from the SBS or Puck device.

☞ Toolbar button 

#### 3.3.1.3 Stop Recording/Playing

This menu option is enabled only if you are either recording or playing a session. It stops the recording or playing that is in progress.

☞ Toolbar button 

#### 3.3.1.4 Pause Playing

This menu option is enabled only if you are currently playing a session. It pauses the playing.

☞ Toolbar button 

#### 3.3.1.5 Print

This menu item has two sub-menu options.

- *Print Radar Screen*: Prints the currently selected radar screen. If there is only one radar screen currently visible then that is the one that will be printed. If you have split the screen into two then the one that is highlighted by a red box around it will be printed.
- *Print Aircraft List*: Prints the Aircraft List (the grid of data on the right-hand side of the screen).

### 3.3.1.6 Exit

This menu option shuts down the application.

- ☞ By default BaseStation displays a box asking “*Do you really want to shut BaseStation down?*” each time you close the application. You can turn this prompt off using the *Confirm on Close* checkbox on the *Display Settings* tab of the *Settings > Display Settings* menu.

## 3.3.2 Edit Menu

### 3.3.2.1 Copy Radar Screen

This menu option copies the currently selected radar screen to the Windows clipboard as a bitmap image that can then be pasted into standard Windows graphical applications.

- ☞ The radar screen can also be copied by pressing Ctrl-C.

### 3.3.2.2 Copy Aircraft List

This menu option copies the data in the aircraft list to the Windows clipboard in a tab delimited text form. It can then be pasted into standard word processors or spreadsheets.

- ☞ The aircraft list can also be copied by pressing Ctrl-L.

## 3.3.3 Radar Menu

- ☞ Most items on this menu can also be accessed via a pop-up menu by right-clicking on a radar screen.

### 3.3.3.1 Zoom In

This menu option increases the “magnification” of the view on the selected radar screen, so that it shows a smaller area but in greater detail.

- ☞ Toolbar button  Keyboard shortcut CTRL-I.

### 3.3.3.2 Zoom Out

This menu option is the opposite of Zoom In.

- ☞ Toolbar button  Keyboard shortcut CTRL-O.

### 3.3.3.3 Reset

This resets the view (i.e. screen centre, zoom, and view toggles) to the default for that view.

- ☞ Toolbar button 

### 3.3.3.4 Pan Screen

The four Pan Screen sub-menu options allow you to shift the centre point of the view, up, down, left and right.

- ☞ You can also pan using the “arrow” buttons on the toolbar or by pressing Ctrl-Alt-U for up, Ctrl-Alt-D for down, Ctrl-Alt-L for left or Ctrl-Alt-R for right.

### 3.3.3.5 Save Radar Screen View

This menu option allows you to save the settings of the currently selected radar screen under a name specified by yourself. Clicking on this menu option brings up the following prompt, showing the name of the *saved view* currently assigned to the selected radar screen. Every radar screen has a saved view associated with it. If you have not created any saved views then the screen will be associated with a view called *Default*.

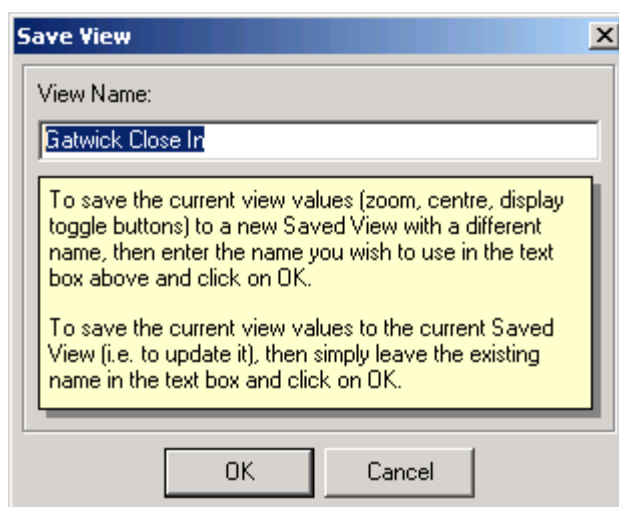


Figure 4: Save View dialog box

To update the named saved view with the current settings of the radar screen, simply click on OK. To save the current settings to a new saved view – and associate the radar screen with that new saved view – simply type in the name of the new view and then click on OK.

The following attributes are recorded in a saved view:

- The view centre.
- The zoom diameter.
- Whether Show All Trails is enabled.
- Whether Show Only Recent Trails is enabled.
- Whether Show Bearing & Distance is enabled.
- Whether Show Waypoints is enabled.
- Whether Show Range Rings is enabled.
- Whether Show Outlines is enabled.
- Whether Display Selected Only is enabled.
- Whether Display Interested Only is enabled.
- Whether the screen stays centred, tracks an aircraft, or tracks the coordinates given by an attached GPS unit.

- It is important to understand that a view is only updated if you click on Save Radar Screen View. If you select a saved view for a radar screen and then for example zoom in, the saved view will still be set to the previous value. If you then shut down the application and rerun it, the application will start up with the radar screen restored to that saved view, with the zoom diameter as saved in the saved view (i.e. as it was before you zoomed in). BaseStation is designed this way so that you can create a set of standard views for yourself and then zoom and pan around without fear that you will inadvertently “overwrite” your saved views.

- Toolbar button 

### 3.3.3.6 Add Radar Screen Tab

This menu item creates an additional radar screen tab, so that you can have two or more radar screens active and switch between them simply by clicking on the tabs that appear at the bottom of the screen. Each tab shows the name of the saved view that is currently assigned to the radar screen on that tab.

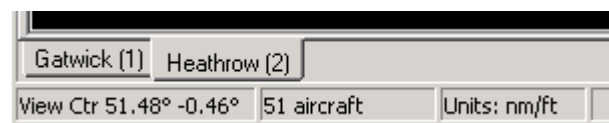




Figure 5: Radar Screen tabs

- Toolbar button  Keyboard shortcut Ctrl-A.
- You can switch between tabs from the keyboard by pressing Ctrl + Alt + [Tab Number]. In the example shown in the above screenshot, you could switch to the Gatwick tab by selecting Ctrl + Alt + 1.

### 3.3.3.7 Remove Radar Screen Tab

This menu option removes the currently selected tab. It is enabled only if you have more than one tab.

- Toolbar button 

### 3.3.3.8 Split Radar Screen

This splits the radar screen on the current tab into two side-by-side screens, each of which can be zoomed and panned independently and can be associated with a different saved view.

When a tab is split into two views, you can select between them simply by clicking inside them. The selected view will have a red border drawn around it.

If the current screen is already split, then this menu item will be called "*Merge Radar Screens*" and clicking on it will remove the right hand screen.

☞ Toolbar button  Keyboard shortcut Ctrl-S.

#### 3.3.3.9 Show Elevation

This menu item causes a separate side elevation view to be displayed below the currently selected radar screen.

If the current screen already has the elevation shown, then this menu item will be called "*Hide Elevation*" and will cause the elevation to be removed.

☞ Toolbar button  Keyboard shortcut Ctrl-V.

#### 3.3.3.10 Set View Centre and Bearing

This menu option brings up a dialog box that allows you to enter in a specific latitude and longitude that the currently selected radar screen is to be centred on. You can also set the bearing that you wish to be looking along. By default, this is north, so that the radar scope shows 0° at the top, and the elevation (if displayed) runs from west to east. Setting the bearing can be useful when you want to align the elevation with the glidepath that aircraft are following at an airport.

#### 3.3.3.11 Centre on Waypoint

This menu option brings up a sub menu that lists your home position (the latitude and longitude you entered in as your actual position when the start-up configuration wizard was running) followed by all of the waypoints. Selecting any of these will cause the currently selected radar screen to be centred on the location of that point.

#### 3.3.3.12 Set Elevation Upper/Lower Limit

By default, the upper limit of the elevation view is 50,000 feet with the lower limit being zero feet. This menu option brings up a dialog box that allows you to change them.

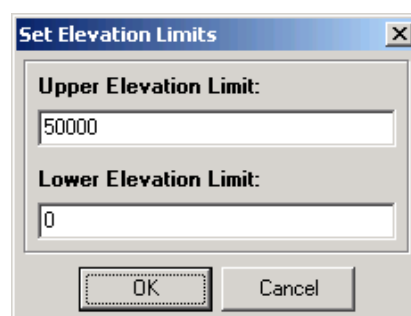


Figure 6: Set Elevation Limits Dialog Box

This is useful if you are zooming right in on an airport, watching aircraft that are just landing or taking off, and are thus very low.

- ☞ Aircraft whose altitude exceeds the elevation upper limit will not be displayed on the elevation view, even if they are visible on the scope. The same is true for aircraft whose altitude is lower than the elevation lower limit.

### 3.3.3.13 Display All Trails

Selecting this menu option causes the trail of every aircraft on the selected radar screen to be displayed, regardless of whether or not it has a tick in the *Show Trails* column of the Aircraft List. If you deselect this option, then trails will be shown only for those aircraft that have a tick in the *Show Trails* column of the Aircraft List.

- ☞ Toolbar button  Keyboard shortcut Ctrl-T.

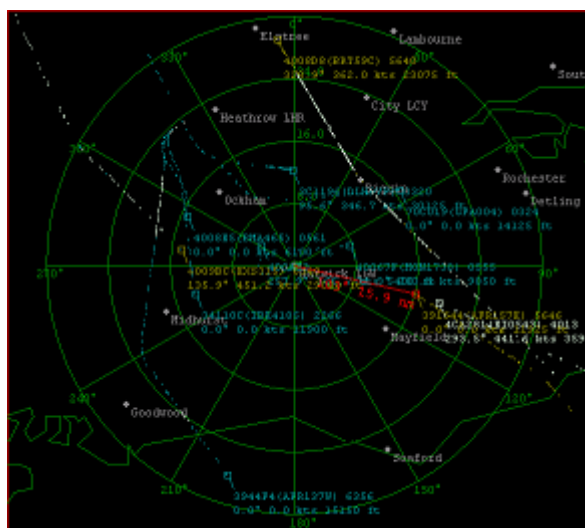


Figure 7: Display All Trails menu item/button selected

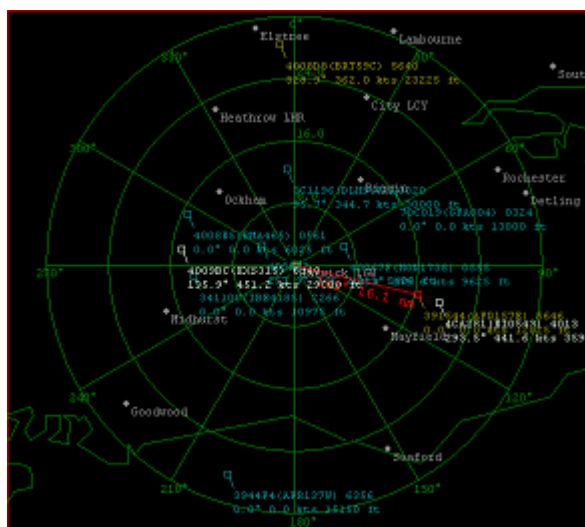






Figure 8: Display All Trails menu item/button not selected



### 3.3.3.14 Show Only Recent Trails

Selecting this menu option causes the aircraft trails to be limited to the last x seconds (by default to 60 seconds). The number of seconds to be displayed in this mode can be set under the *Aircraft Display* tab of the *Settings > Display Settings* menu. Deselecting this option will cause the full trail history to be displayed.

-  This option affects only those aircraft that are set to display their trails, either using the *Display All Trails* option above or the *Toggle Tracking on Selected Aircraft* option (see the *Aircraft* menu).
-  Toolbar button  Keyboard shortcut Ctrl-N.
-  Displaying the full trails can significantly increase the processing load on the computer needed to update the display.

### 3.3.3.15 Display Bearing & Distance

Selecting this menu option will cause a range and bearing line to be drawn on the selected Radar Screen.

☞ Toolbar button  Keyboard shortcut Ctrl-B.

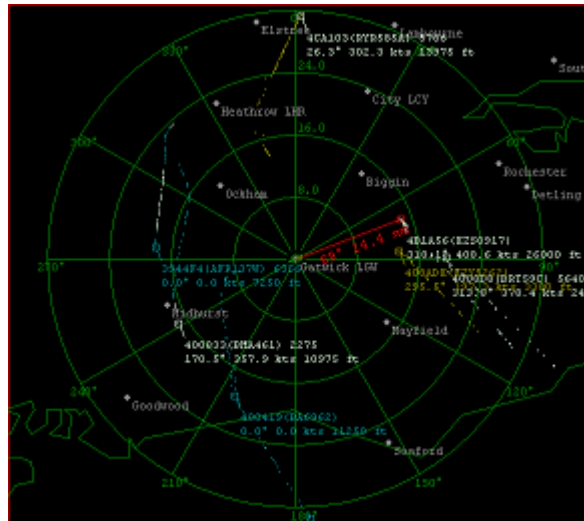


Figure 9: Display Bearing & Distance menu item/button selected

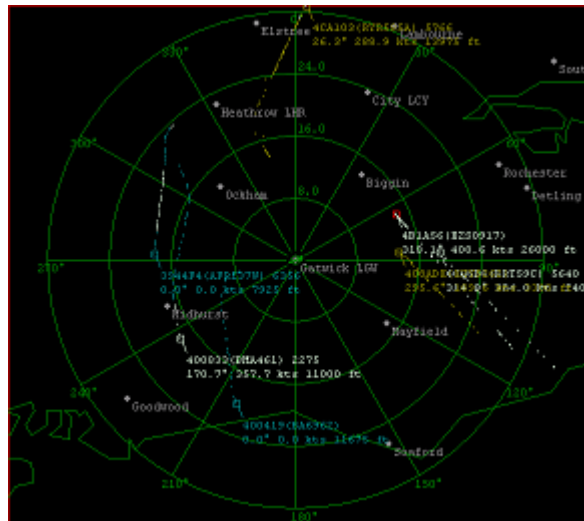


Figure 10: Display Bearing & Distance menu item/button not selected

### 3.3.3.16 Display Waypoints

Selecting this menu option will cause waypoints to be displayed.

☞ Toolbar button  Keyboard shortcut Ctrl-W.

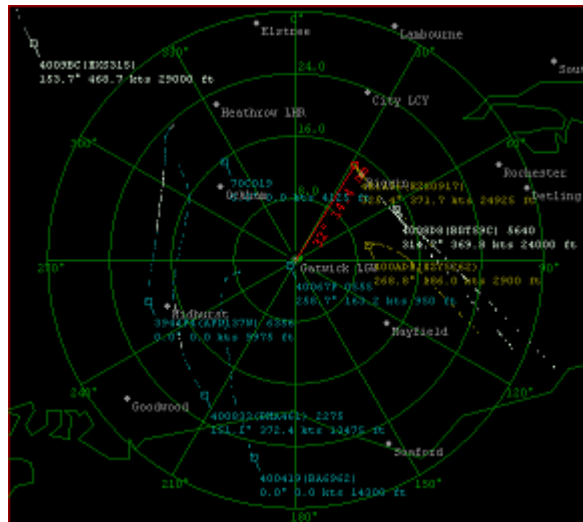


Figure 11: Display Waypoints menu item/button selected

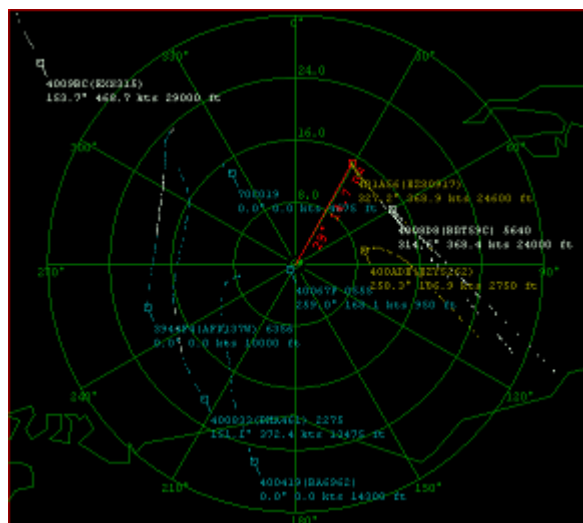


Figure 12: Display Waypoints menu item/button not selected

### 3.3.3.17 Display Range Rings

Selecting this option will cause range rings to be displayed.

☞ Toolbar button  Keyboard shortcut Ctrl-G.

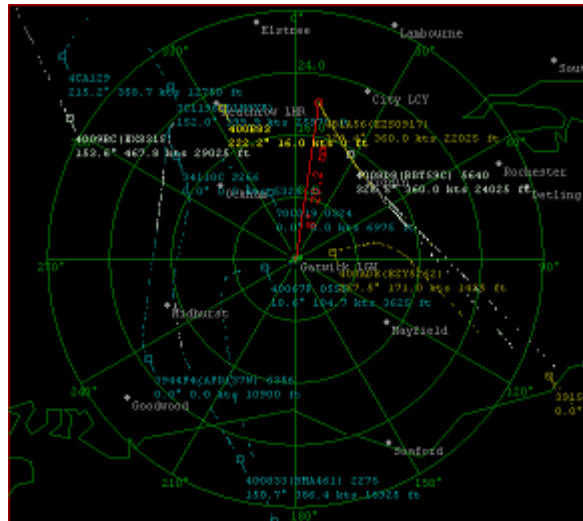


Figure 13: Display Range Rings menu item/button selected

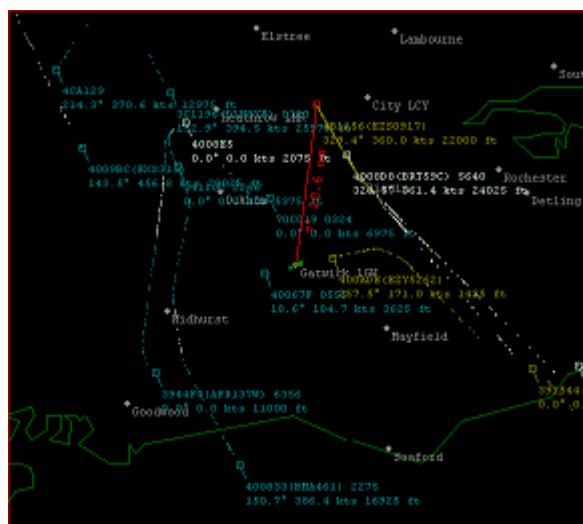


Figure 14: Display Range Rings menu item/button not selected



### 3.3.3.19 Display Selected Only

This option toggles whether the radar screen displays only the aircraft that is currently selected. When this feature is active you will see only one aircraft on the screen.

☞ Toolbar button  Keyboard shortcut Ctrl-Alt-S.

### 3.3.3.20 Display Interested Only

This option toggles whether the radar screen displays only those aircraft whose *Interested* field (in the database) is set to True.

☞ Toolbar button  Keyboard shortcut Ctrl-Alt-I.

### 3.3.3.21 Display Centre & Bearing Tracking

This menu item sets whether or not the radar screen will track the currently selected aircraft and, if so, what factors it will track.

If it is set to *None*, then the radar screen will stay set to the latitude, longitude and bearing that you have set for it.

If it is set to *Centre Only*, then the centre of the screen will always stay positioned on whichever aircraft is currently selected.

If it is set to *Centre & Bearing*, then the centre of the screen will always stay positioned on whichever aircraft is currently selected and – in addition – the bearing (direction) of the screen will be set to the current track of the aircraft. The aircraft will appear to be flying straight up the screen, with the outlines and waypoints wheeling around it whenever it turns.

☞ If the selected aircraft stops being displayed, and you don't select a new aircraft, the screen will stay on the last latitude, longitude and bearing received from the aircraft. Also, if you set this option back to *None*, the screen will still stay on the last latitude, longitude and bearing. In other words, changing back to *None* will just stop the screen centre and bearing changing when a new aircraft becomes selected, but it won't change the current screen centre and bearing. If you want to revert to the settings for the saved view, then you need to click on the *Radar > Reset* menu option (or alternatively, reselect the current view in the *Saved View* drop-down on the toolbar).

If it is set to *GPS*, then the centre of the screen will always stay positioned on the latitude and longitude coordinates supplied by an attached GPS receiver, assuming that the GPS unit is able to provide valid coordinates (i.e. that it has got a fix). This menu option is only visible if you have enabled the use of a GPS feed (by ticking the *Use GPS Feed* checkbox on the GPS tab of the *Hardware Settings* dialog box).

### 3.3.4 Aircraft Menu

#### 3.3.4.1 Expanded All Aircraft List

This menu item duplicates the effect of the *Aircraft List Expand* button. Selecting it (so that it is displayed with it a check mark) expands the aircraft list (see Figure 2). Clicking on it again to deselect it (no check mark) returns the aircraft list to its normal width.

#### 3.3.4.2 Show All Aircraft (Inc. Non Position)

This menu item toggles whether all aircraft are to be shown in the Aircraft List, regardless of whether or not position information has been received for them. By default, only those aircraft whose positions are known, and can therefore be plotted on the radar screen, are shown in the aircraft list.

#### 3.3.4.3 Show Only Aircraft Marked Interested

This toggles whether the Aircraft List shows only those aircraft whose *Interested* field (in the database) is set to true. By default, all aircraft are displayed.

#### 3.3.4.4 Display Full Info Window

This menu option displays a floating window that contains the details of whichever aircraft is currently selected.

**Aircraft Details**

Flag:	Status: <span style="color: red;">Signal Lost</span>	Squawk: 5233
Lat: 51.536°	Altitude: 8,000 ft	Speed: 253.1 kts
Long: 0.415°	Vert. Rate: 0	Track: 153.7°

**Registration Data**

ModeS (Hex): 4CA252	Registration:	Country: Ireland
Status:	Previous ID:	Current Reg Date:
First Reg Date:	De-reg Date:	
Manufacturer:	Type:	Serial No:
Popular Name:	Aircraft Class:	
Generic Name:	Engines:	
Ownership Status:	MTOW:	C of A Cat.:
Total Hours:	Year Built:	C of A Expiry:
Registered Owners:		

**UserNotes**

Refresh Details Edit Details Close

Figure 17: Aircraft Details Window

This details in this window will be updated each second. You can leave this window visible while you select other aircraft – it will always display whichever aircraft is currently selected.

- ☞ An easier way to display this window is simply to double-click on either the aircraft's box on the Radar Screen, or on the aircraft's row in the Aircraft List.

Clicking on the Edit Details box brings up an edit dialog box that allows you to enter details for the aircraft.

- ☞ You can also edit an aircraft's details using the BaseStation Reporter application described later in this manual.

#### 3.3.4.5 Sort By

This menu option allows you to set which column in the Aircraft List you wish to sort on.

- ☞ An easier way to do this is simply to click on the heading at the top of the column in the actual list itself. Clicking a second time on the same column heading will reverse the sort order (indicated by an upward or downward arrow on the column heading).

#### 3.3.4.6 Columns

This menu option allows you to set which columns you wish to appear in the Aircraft List. By default, all columns are visible, but you can turn off those you do not need.

If a column name has a check mark next to it then that column is visible. Clicking on a checked item will deselect it and hide the column. Clicking on an unchecked column will select it and restore the column.

#### 3.3.4.7 Toggle Tracking on Selected Aircraft

The selected aircraft is the one that is highlighted in the Aircraft List (by a solid blue bar) and in the Radar Screen (the aircraft box is drawn in red). This menu item toggles whether the selected aircraft is to be tracked (have its trail shown).

Aircraft that are set to be tracked have a tick in the *show trail* column in the Aircraft List. The value in that column is overridden however if the *Display All Tracks* option is set.

#### 3.3.4.8 Refresh DB Data For Selected

Clicking on this menu option re-reads the database record for the currently selected aircraft.

- ☞ You would normally only need to do this if you've just updated the aircraft's registration data with BaseStation Reporter (or with another application) and want BaseStation to re-read the record and get the updated data.

#### 3.3.4.9 Centre on Selected Aircraft

This centres the radar screen on the current position of the selected aircraft. (Note, the Radar Screen will then stay fixed on that particular point, not the aircraft itself).

- ☞ This option is useful if an interesting aircraft has appeared on your Aircraft List, but is not visible on the Radar Screen. Rather than zoom and pan around looking for it, you can simply centre on it.



#### 3.3.4.10 Caption Position

The first four items on this sub-menu (Top Left, Top Right, Bottom Left and Bottom Right) allow you to set the radar screen caption for the selected aircraft to a different position relative to the aircraft. This is useful when two aircraft are flying close to each other and their captions are overlapping.

The last two items (Rotate Anti-Clockwise and Rotate Clockwise) change the caption position of the selected aircraft to the next position in the indicated direction. For example, if the caption is currently Top Left and you click on Rotate Clockwise, it will change to Top Right.

- ☞ You can easily arrange all the captions on the screen by using the keyboard shortcuts F9 and F10 to cycle through the aircraft, and using F11 and F12 to rotate the captions clockwise and anti-clockwise.

#### 3.3.4.11 Refresh DB Data For All

This command is similar to *Refresh DB Data For Selected* except that it refreshes the data for all of the aircraft in one operation.

#### 3.3.4.12 Select Previous Aircraft

This menu option changes the selected aircraft to be the first aircraft before the current one in the aircraft list that is broadcasting its position (i.e. has an aircraft symbol).

- ☞ It is quicker to use the keyboard shortcut (the F9 key) to cycle backwards through the aircraft displayed on the screen.

#### 3.3.4.13 Select Next Aircraft

This menu option is identical to the *Select Previous Aircraft* option, except that it cycles forwards through the aircraft list, and its keyboard shortcut key is F10.

### 3.3.5 Settings Menu

#### 3.3.5.1 Display Settings

This menu option brings up the *Display Settings* dialog box:

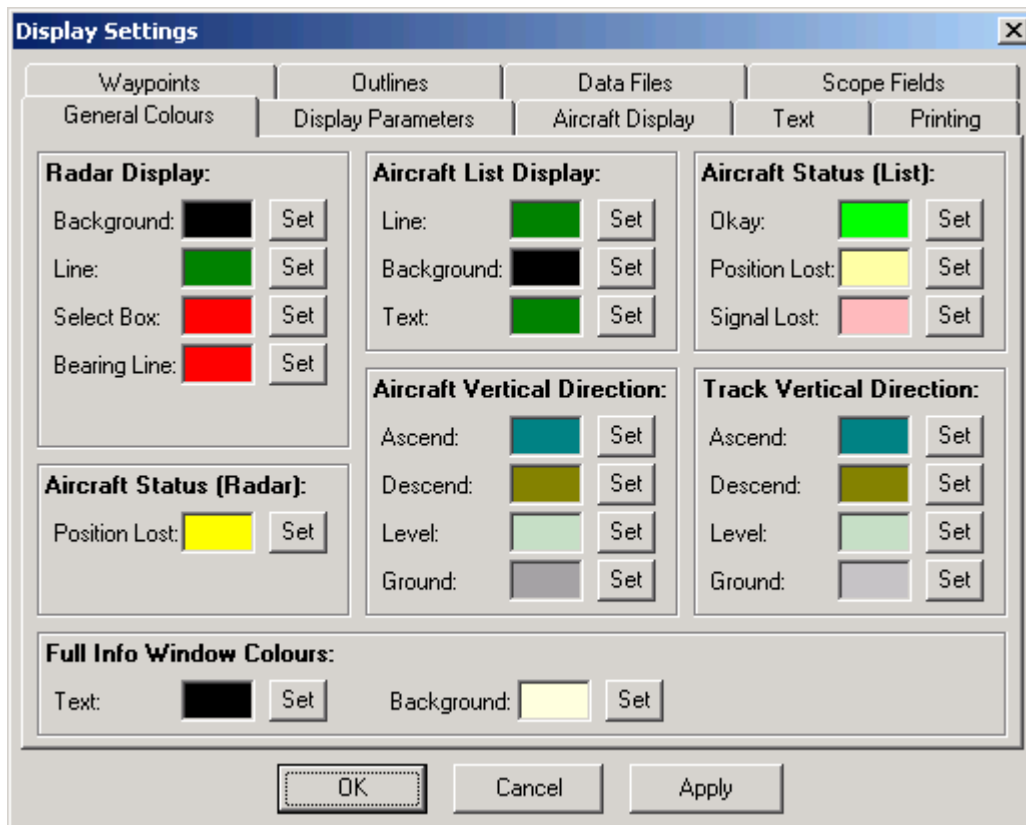


Figure 18: The Display Settings dialog box (General Colours tab)

The settings on the **General Colours** tab concern the colours used by the application. If you want to experiment with colours, then clicking the Apply button saves the updated colours – which will cause the application to start using those colours – without exiting the dialog box.

**Radar Display:** These set the colours used on the Radar Screen.

*Line* sets the colour used in the Range Rings (and the horizontal lines in the Elevation view) as well as the text associated with the Range Rings.

*Select Box* is the colour used both for the box around a selected Radar Screen as well as the colour used to display a selected aircraft.

*Bearing Line* is the colour used to display the bearing and range line for the selected aircraft.

**Aircraft List Display:** These set the colours used in the Aircraft List.

**Aircraft Status (Radar):** *Position Lost* sets with which colour is used to display aircraft on the radar screen if the *Position Lost* timeout

period has been exceeded. The default colour is yellow. For more information about the timeout see the description of the *Settings > Data Settings* menu item.

**Aircraft Status (List):** *Okay*, *Position Lost* and *Signal Lost* define the colours used for the aircraft symbol in the *Status* column of the Aircraft List. For more information about the Aircraft Status see the description of the *Settings > Data Settings* menu item.

**Aircraft Vertical Direction:** These set the colours used to display aircraft on the Radar Screen, including the box representing the location of the aircraft, the caption text, and the line connecting the two. Aircraft are coloured according to whether they are ascending, descending, flying level, or on the ground. However, if no signal is received for the *Position Lost* timeout period (by default, this is 30 seconds), the aircraft changes to the colour set by the *Position Lost* colour setting – regardless of whether it was ascending, descending, level, or on the ground.

**Track Vertical Direction:** These settings define the colours used for the aircraft trails. These are similar to the *Aircraft Vertical Direction* settings, except that there is no *Position Lost* colour. This is because each dot in the track represents a time when a position was received.

**Full Info Window Colours:** These settings select the colours used in the Full Info Window.

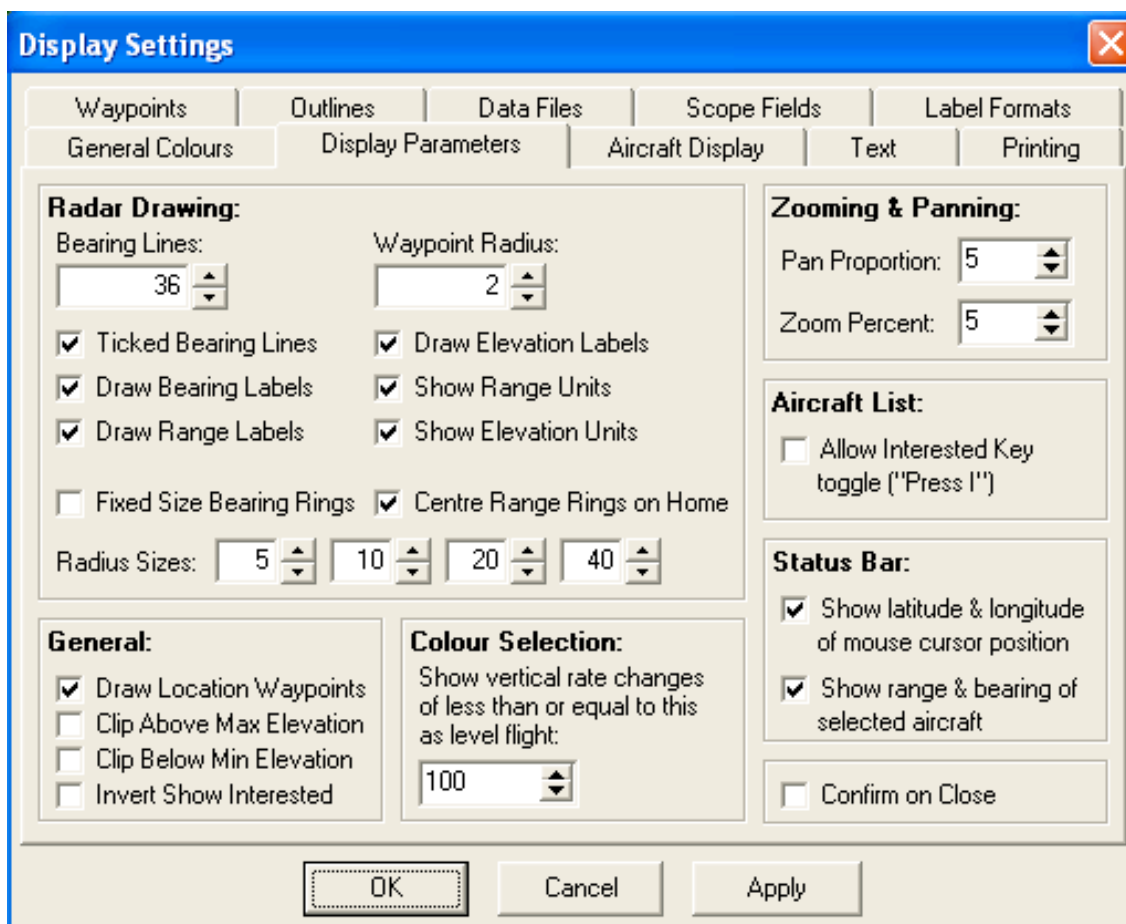


Figure 19: The Display Settings dialog box (Display Parameters tab)

The **Display Parameters** tab allows the user to configure various aspects of BaseStation's screens.

### Radar Drawing:

*Bearing Lines* determines how many segments the radar display will be divided into by the range rings. The minimum is four, which gives four quadrants.

If *Ticked Bearing Lines* is checked then small ticks are drawn instead of the radial lines.

If *Fixed Size Bearing Rings* is checked, then the bearing rings are drawn at fixed distances from the centre of the rings, rather than being sized to fit the view. By default, fixed size rings will be drawn at radii of 5, 10, 20 and 40 nautical miles, but this can be changed using the *Radius Sizes* spin edit controls.

If *Centre Range Rings on Home* is checked, then the range rings are centred on the currently selected location (i.e. home), rather than being centred on the view.

*Waypoint Radius* controls the size of the dots that are drawn for Waypoints.

**General:**

If *Draw Location Waypoints* is selected then a waypoint is drawn at each location defined by the Locations Manager (this is an easy way of having a waypoint drawn at your home position).

The *Clip Above Max Elevation* and *Clip Below Min Elevation* options will, if set, cause the radar screen to display only those aircraft whose altitude is below and above the maximum and minimum altitudes defined in the Set Elevation Limits dialog box.

If *Invert Show Interested* is checked, the the Display Only Interested and Show Only Interested buttons work in the opposite way – that is, selecting them will cause only aircraft that you have **not** marked as interested to be displayed.

**Zooming & Panning:** These parameters determine how far the screen moves sideways while panning (decreasing the number will increase how far it pans), and by which percentage of the existing view it zooms in each step when zooming in and out.

**Colour Selection:** Aircraft flying notionally level sometimes make slight up and down movements. To avoid displaying “rainbow coloured” trails, changes of less than the configured amount are ignored when determining which colour to use for the next dot in the trail.

**Status Bar:**

If *Show latitude and longitude of mouse cursor position* is checked, then a panel appears on the status bar at the bottom of the application window, that shows the latitude and longitude of the position on the radar screen that the mouse pointer is currently over.

If *Show range and bearing of selected aircraft* is checked, then a panel on the status bar appears that shows the range and bearing of the currently selected aircraft. The data displayed is the same as that displayed on the radar screen when the *Display Bearing & Distance* option is selected, but the status bar be easier to read when the display is cluttered.

**Aircraft List:**

If *Allow Interested Key Toggle* is set to true, then you can toggle the status of an aircraft’s Interested field by simply selecting it in the Aircraft List and then pressing the I key. This setting is set to false by default in order to guard against inadvertent editing of the database.

**Confirm on Close:** If this box is checked then you will be asked “Do you really want to shut BaseStation down?” each time you close the application.

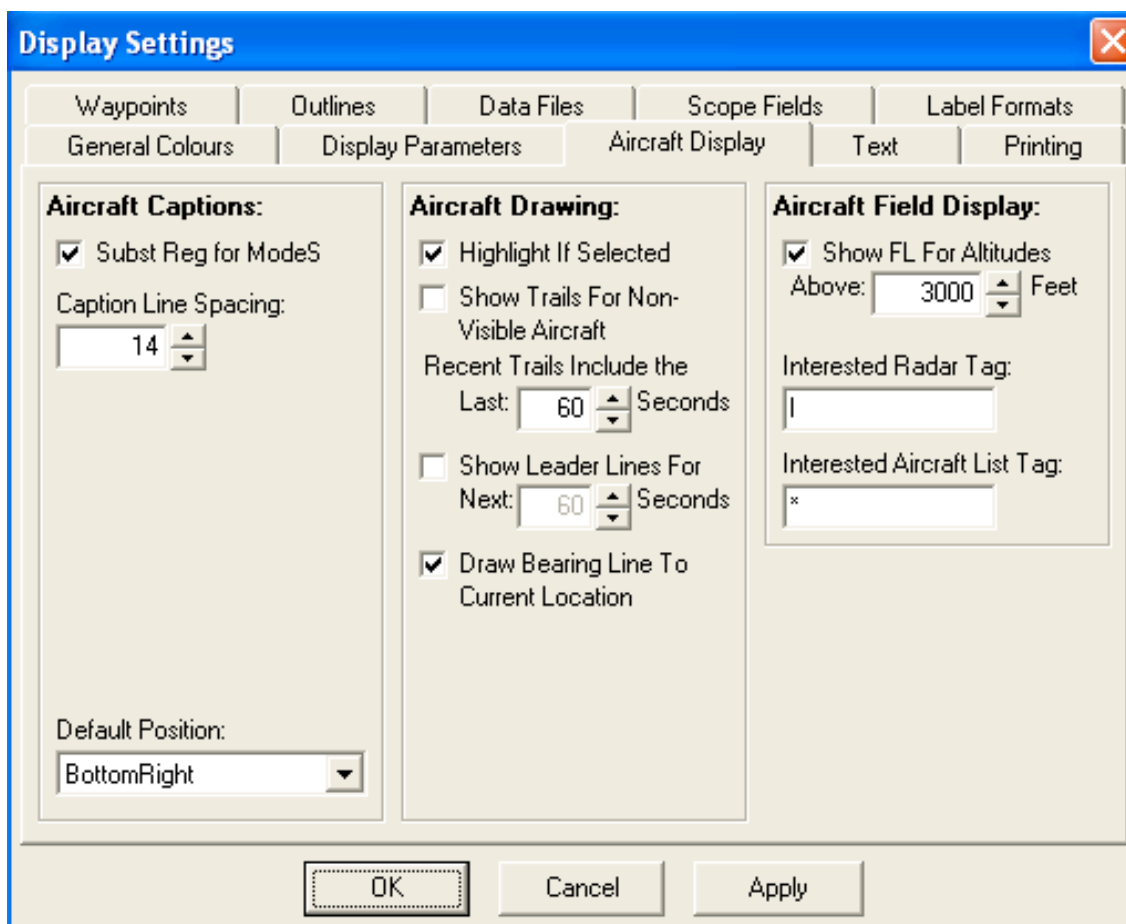


Figure 20: The Display Settings dialog box (Aircraft Display tab)

The **Aircraft Display** tab allows configuration of the way aircraft are displayed on the screen.

**Aircraft Captions:** These settings configure which data items are displayed in the caption beside each aircraft on the radar screen.

*Subst Reg for ModeS* is a special case that can be used where the ModeS field has been set to be displayed (using the Scope Fields tab). If checked, then the aircraft's radar screen caption will show the ModeS code where it does not have a registration for that aircraft, but the registration instead where it does.

- ☛ This means that if you have this option checked, you should set the Registration field (in the Scope Fields tab) to **not** be displayed – otherwise you'll end up with Registration being shown twice.

*Caption Line Spacing* allows you to set the gap between each line of text in the radar caption.

*Default Position* sets where the caption will, by default, be drawn on the radar screen relative to the aircraft.

### **Aircraft Drawing:**

*Highlight If Selected* sets whether the aircraft that is currently selected (this is also shown by a blue highlight bar in the Aircraft List)

should be highlighted on the Radar Screen by being drawn as a red box (rather than whichever colour would indicate its ascending/descending/level/ground status). This is the default behaviour.

*Show Trails For Non Visible Aircraft* sets whether or not trails are displayed for aircraft that are no longer visible. By default, if an aircraft disappears from the screen, either by flying off the edge, or if no message is received from it for 35 seconds (or the time configured using *Settings > Data Settings*), then the trail is also removed from the screen. The trail will only reappear if the aircraft itself reappears. However, if you check this setting, then the trail will continue to be shown until the aircraft is removed from the Aircraft List (which by default happens if no message is received for a further 5 minutes).

*Recent Trails Include The Last x Seconds* allows you to define the number of seconds to be included in the most recent portion of an aircraft trail, whenever the *Show Only Recent Trails* mode is set. Note that this only applies if the aircraft set to have its trail drawn, or if *Display All Trails* is selected.

*Show Leader Lines For Next x Seconds* allows you to configure BaseStation to draw lines ahead of an aircraft, showing its predicted path over the selected period. This is a demonstration feature, to be implemented more completely in a future release of BaseStation.

### **Aircraft Field Display:**

The *Show FL For Altitudes Above x Feet* control will, when set, cause altitudes above that level to be shown as flight levels rather than in feet. For example, an altitude of 8500 feet would be shown as FL85.

The *Interested Radar Tag* and the *Interested Aircraft List Tag* configure which characters are used if the *Interested* field is displayed on the radar screen or in the Aircraft List respectively.

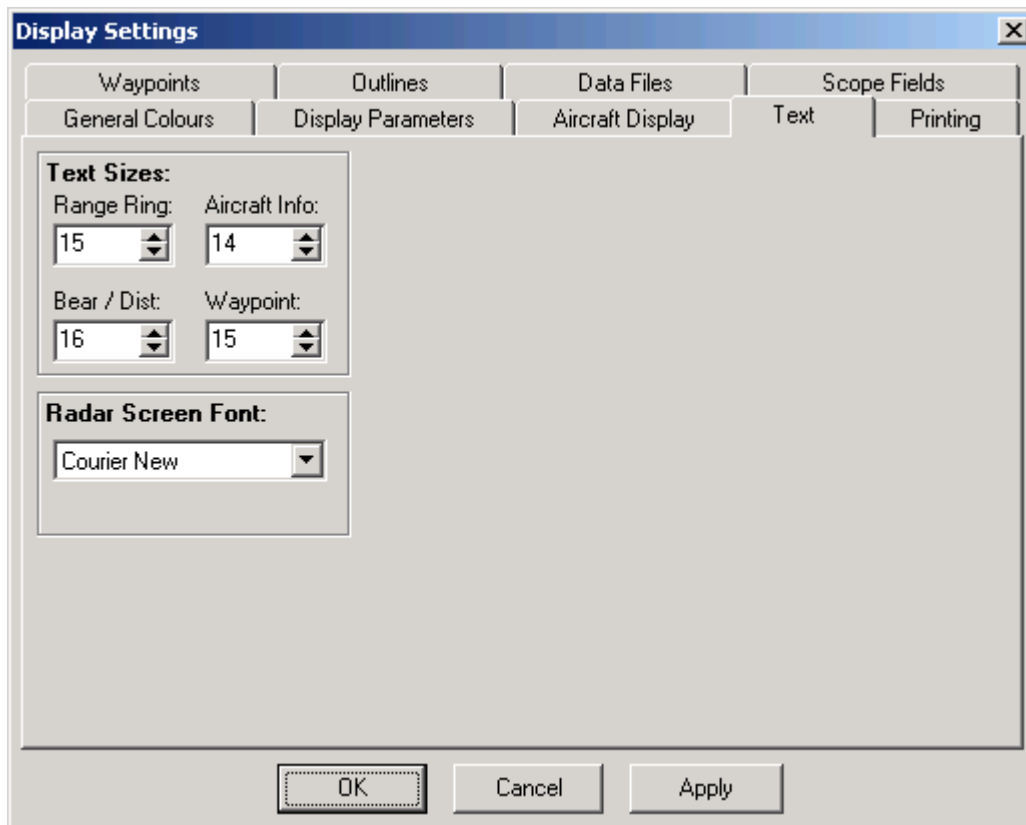


Figure 21: The Display Settings dialog box (Text tab)

The **Text** tab allows configuration of certain text displayed on the screen.

**Text Sizes:** These boxes set the size of various categories of text that are written to the radar screen.

**Radar Screen Font:** This determines which font is used to draw the text on the radar screen.



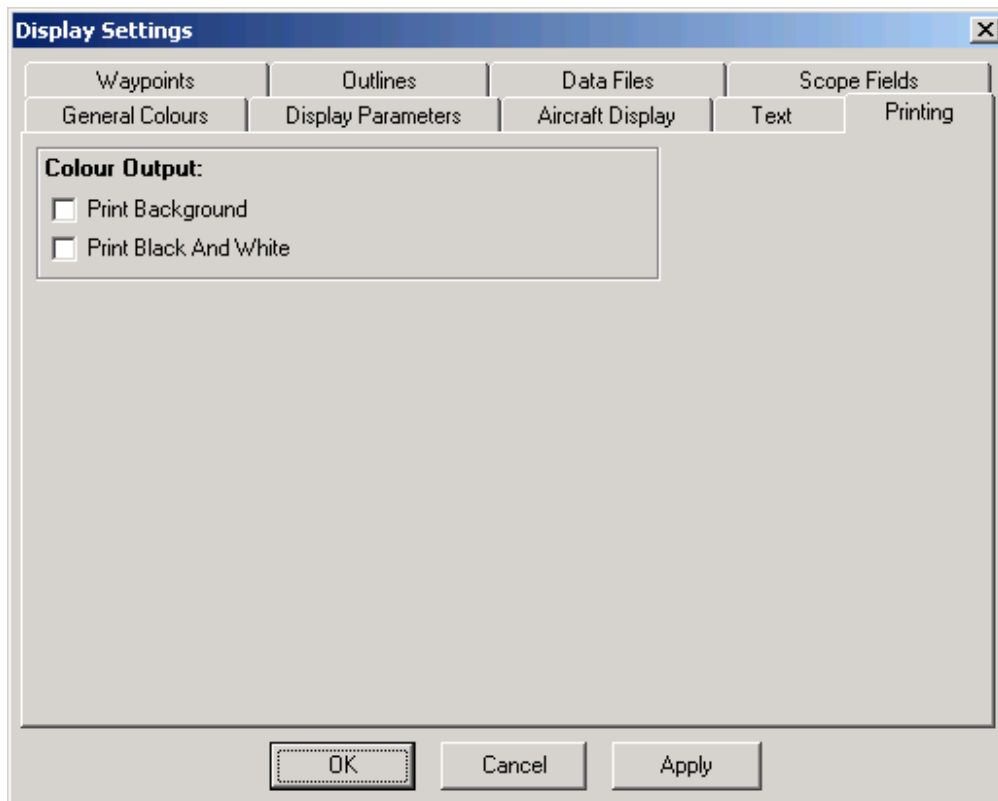


Figure 22: The Display Settings dialog box (Printing tab)

The **Printing** tab determines how radar screen images are printed.

*Print Background* sets whether or not the background (which by default is black) is printed when you print the radar screen. Leaving this box unchecked will generally result in less ink or toner being consumed by the printer.

*Print Black and White* sets whether the radar screen is printed in black and white instead of colour.

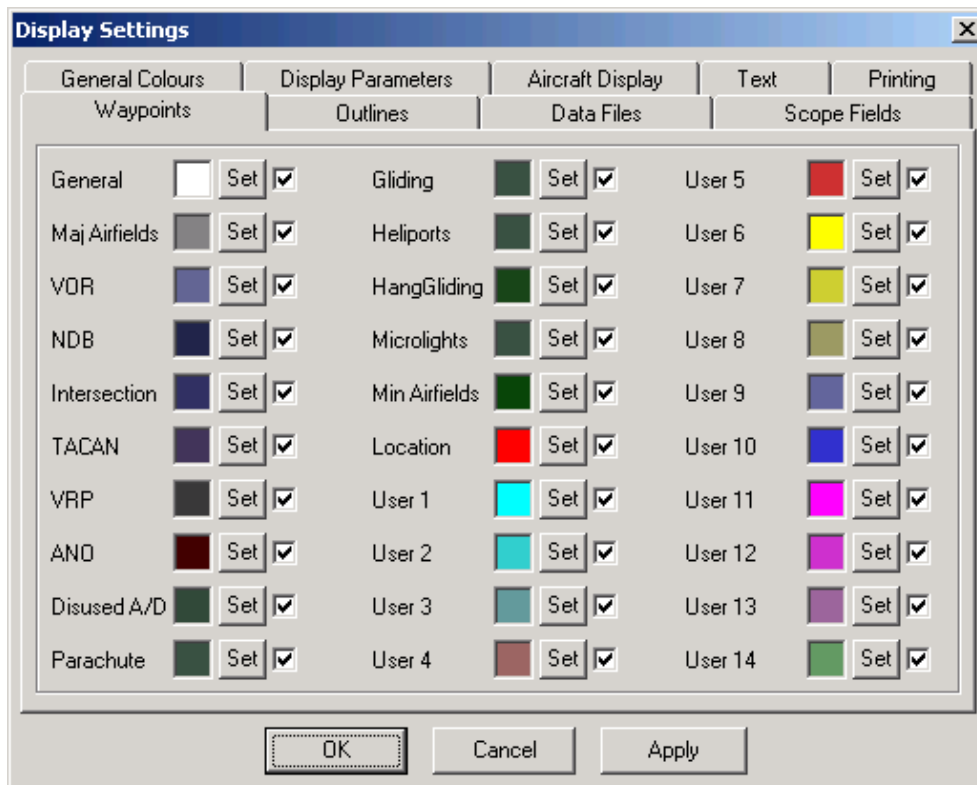


Figure 23: The Display Settings dialog box (Waypoints tab)

The **Waypoints** tab allows you to set the colours used for each type of waypoint. It also allows you to select which types of waypoints you wish to be visible (check the checkbox to make them visible, uncheck it to hide them).

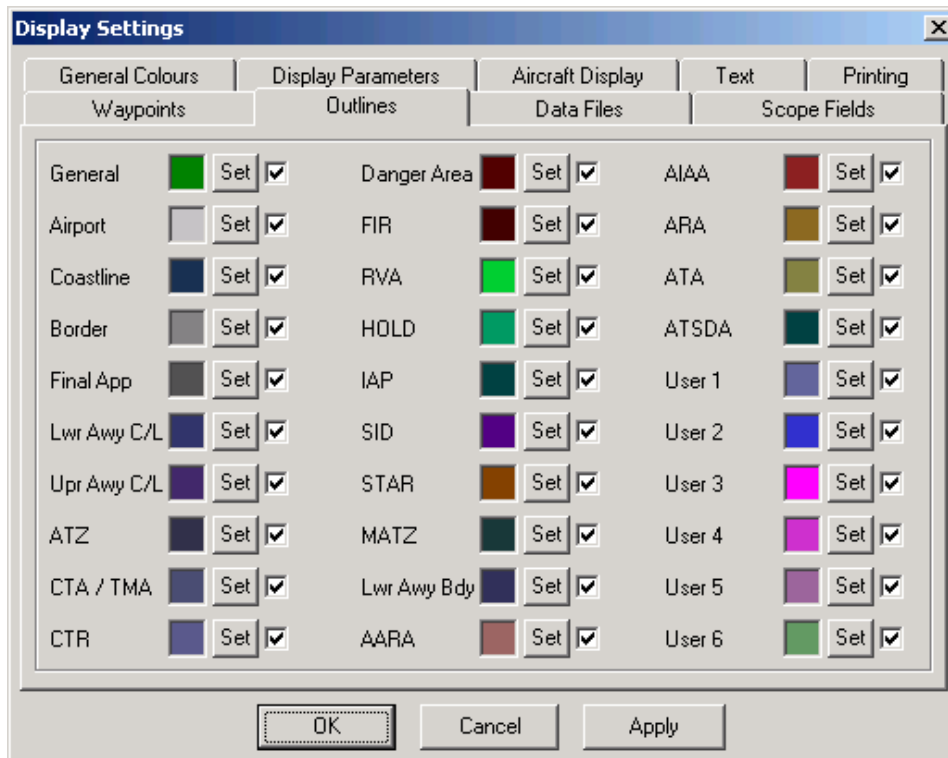


Figure 24: The Display Settings dialog box (Outlines tab)

The **Outlines** tab lets you set the colours used for each type of outline. It also allows you to select which types of outlines you wish to be visible (check the checkbox to make them visible, uncheck it to hide them).

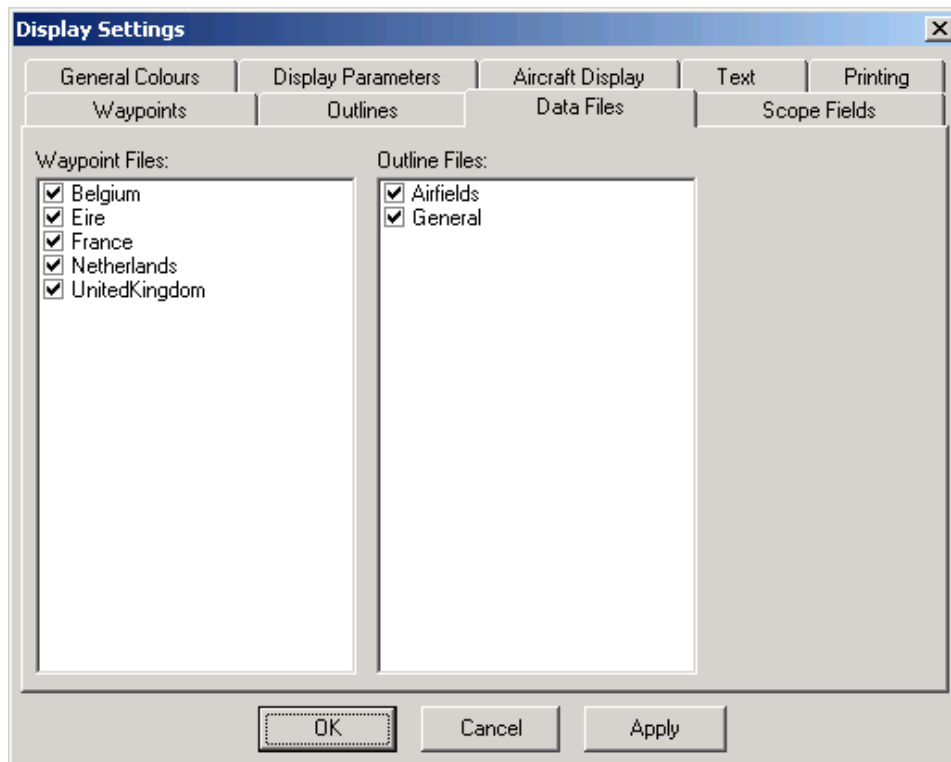


Figure 25: The Display Settings dialog box (Data Files tab)

The **Data Files** tab displays the outline and waypoints files that are in the folders *(Installation path)\Outlines* and *(Installation path)\Waypoints* respectively, where *(Installation path)* denotes the folder where BaseStation is installed. The tab allows you to select which specific files are loaded.

To stop a file being loaded, simply uncheck the checkbox next to its name. When you click on OK or Apply, the system will purge and reload the waypoint or outline lists, loading only those files you have set to be loaded.

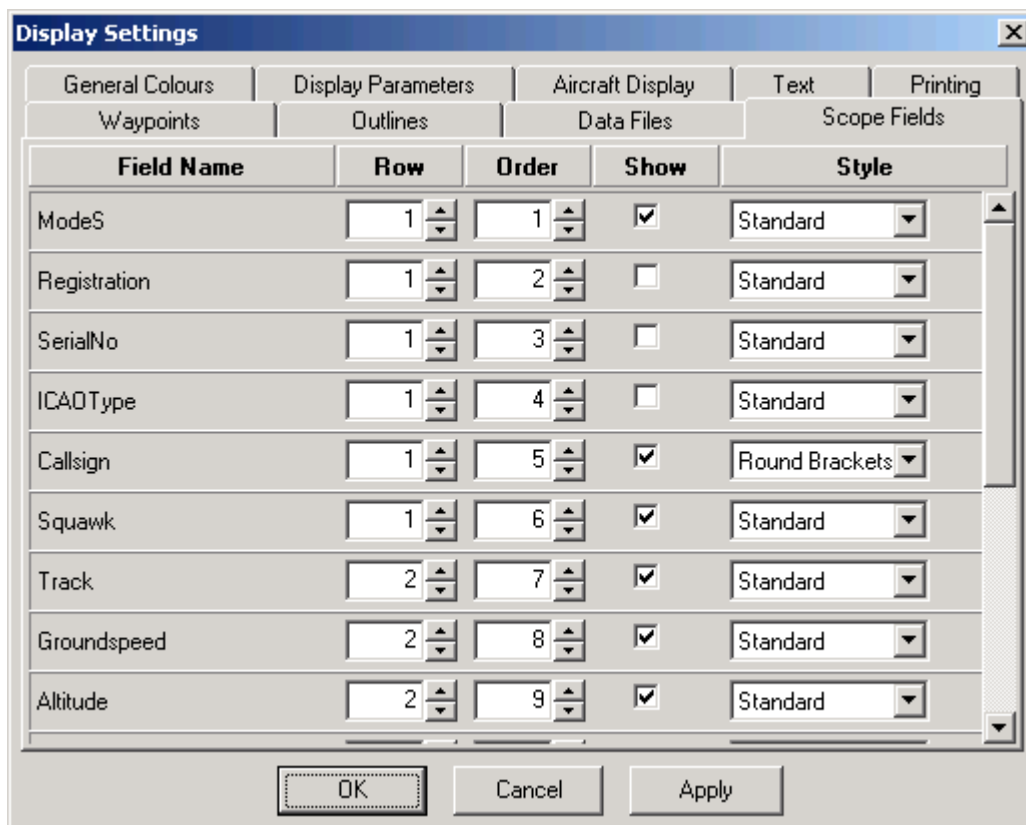


Figure 26: The Display Settings dialog box (Scope Fields tab)

The **Scope Fields** tab gives you complete control over the fields that are shown in the aircraft tags on the radar screen.

For each field that can be displayed in the caption, you can set four settings:

- **Show:** This sets whether or not the field will be displayed. If this checkbox is not checked, then the field will not be displayed the other three settings for this field are ignored.
- **Row:** This setting determines which row of the tag the field will appear in. By default, there are two rows, but you can have up to five. Row must be set to a value between 1 and 5.
- **Order:** This setting determines the order in which fields are displayed on a row (whereas the *Row* parameter sets which row they are displayed on).
- **Style:** This sets the style in which the field is displayed. If set to the default (Standard) then the field value is simply copied into the caption. Alternatively, you can opt to have the value enclosed by brackets, have dashes or bars before or after it, and so on.

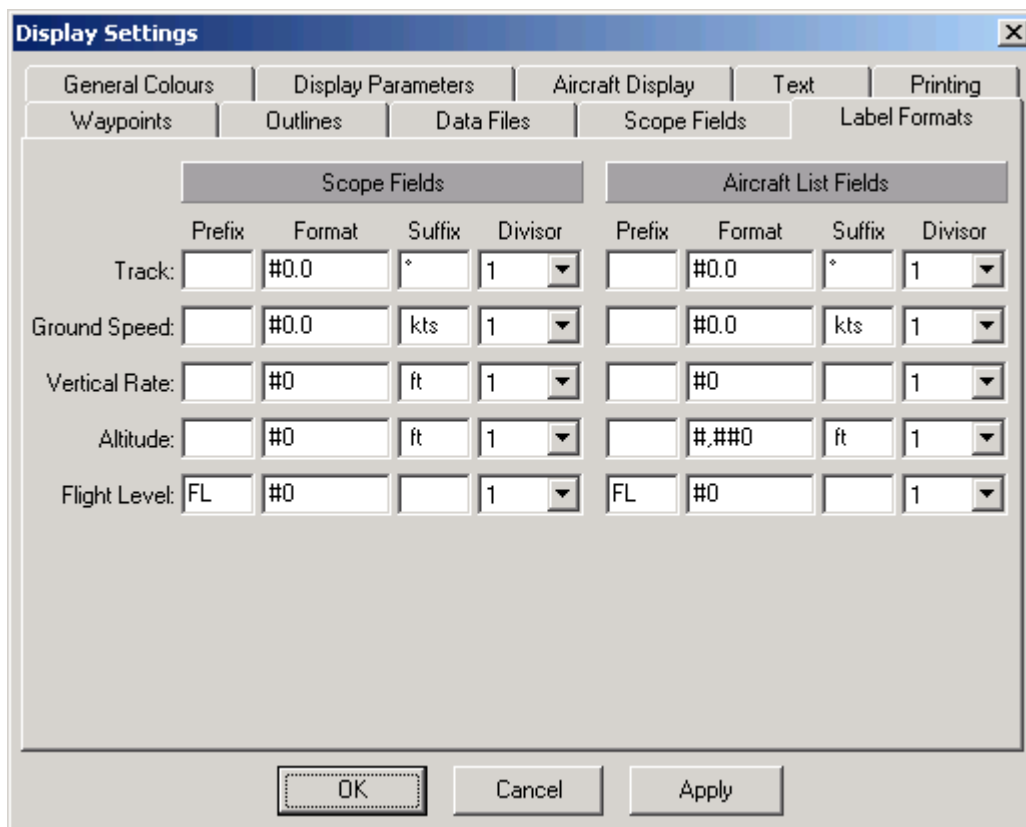


Figure 27: The Display Settings dialog box (Label Formats tab)

The **Label Formats** tab allows you to set the ways in which field values are displayed on the radar scope and in the aircraft list. This enables you to have as much, or as little, detail as you wish, which can be a great help if the radar scope is getting cluttered.

For example, by default the setting for the ground speed field on the radar scope is:

Prefix: [blank]  
 Format: #0.0  
 Suffix: kts  
 Divisor: 1

This will cause the radar scope to display track values in the form: **157.3 kts** (note that there is a space before the kts in the Suffix edit box).

If you changed it to the following:

Prefix: G  
 Format: #0  
 Suffix: [blank]  
 Divisor: 1

it would display values in the form: **G157** (note that in this example, there is no space after the G).

You can use the divisor setting to modify the value displayed. If you changed the divisor of the above example to 10, for example, the value displayed would change to **G16**.

- ✍ The Prefix and Suffix fields can contain any text. The Format field however should contain only the characters "#", "0", ",", and ".".

### 3.3.5.2 Data Settings

This menu option brings up the Data Settings dialog box:

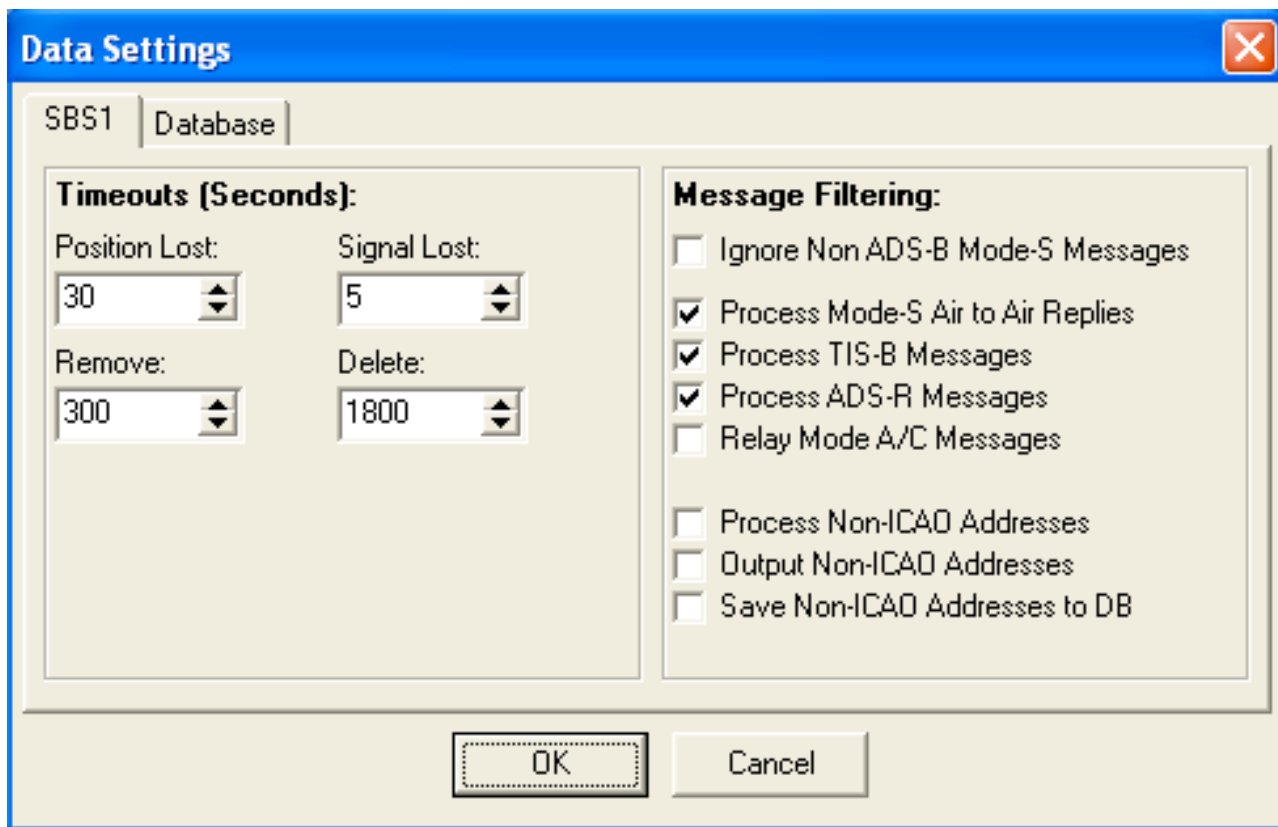


Figure 28: The Data Settings dialog box (SBS tab)

#### Message Filtering:

**Ignore Non ADS-B Mode-S Messages:** By default BaseStation receives and processes both ADS-B and non-ADS-B Mode-S messages. However, you can turn off the processing of non-ADS-B messages by checking the *Ignore Non ADS-B Mode-S Messages* checkbox.

#### Process Mode-S Air to Air Replies:

#### ***SBS-3 SBS-1eR SBS-1e, 1090 Puck***

Enables forwarding by the SBS or Puck of Mode-S Air-to-Air Surveillance Replies (TCAS Replies). As these contain altitude information, this may enable BaseStation to display the altitude of non-ADS-B but Mode-S equipped aircraft, even when they are outside the coverage of Mode-S radar stations.

- ☞ Enabling this feature will significantly increase the amount of data transmitted from the SBS or Puck to the PC, and hence the bandwidth required when connecting over a network.
- ☞ This feature is available currently available only on the SBS-3, 1090 Puck and SBS-1e/eR and will also require a firmware update on the SBS-1e/eR if the firmware build number displayed by the *Help > About BaseStation* menu is less than 517.

### **Process TIS-B Messages:**

#### ***SBS-3 SBS-1eR SBS-1e, 1090 Puck***

This enables processing of TIS-B messages by BaseStation. These are similar to ADS-B messages, but are broadcast by radar ground stations, mainly in the USA to relay data about non-ADS-B aircraft, so that aircraft equipped with ADS-B receivers can “see” them.

- ☞ This feature will require a firmware update on the SBS-1eR or SBS-1e if the firmware build number displayed by the *Help > About BaseStation* menu is less than 517.

### **Process ADS-R Messages:**

#### ***SBS-3 SBS-1eR SBS-1e, 1090 Puck***

This enables processing of ADS-R messages by BaseStation. These messages arise because there are two channels used for ADS-B in the USA. These are the 1090 MHz world-wide radar reply channel monitored by BaseStation, and also the 978 MHz UAT channel which uses a different transmission format. Ground stations in the USA are being equipped to re-broadcast data received on one channel as messages on the other channel. This allows differently equipped aircraft to be aware of each other.

- ☞ This feature will require a firmware update on the SBS-1eR or SBS-1e if the firmware build number displayed by the *Help > About BaseStation* menu is less than 517.
- ☞ TIS-B and ADS-R messages are intended to be transmitted from ground to air and normally will be received only if the antenna is within line-of-sight of a ground station.

### **Relay Mode A/C Messages: *SBS-3, 1090 Puck***

This checkbox enables output of Mode A and C data on BaseStation’s raw data output over Ethernet (port 30006). BaseStation does not currently use Mode A/C messages itself but they can be used by third party applications connecting to this port. Enabling this option will increase data bandwidth significantly.

**Process Non-ICAO Addresses:*****SBS-3 SBS-1eR SBS-1e 1090 Puck***

Aircraft or ground vehicles equipped with Mode S radar transponders use 24-bit addresses from a block allocated to each country by ICAO and which are unique to a particular aircraft or vehicle. This is the code that is displayed as a 6-character hexadecimal number by BaseStation. However ADS-B, TIS-B and ADS-R messages that do not originate from Mode S transponders are allowed to use a different set of 24-bit addresses that are not allocated by ICAO and do not have to be unique. This applies for example to certain ground vehicles. TIS-B messages may also use a 24-bit address made up of the 12-bit Mode A (Squawk) code plus a 12-bit track number allocated by the radar station.

If you enable this feature then BaseStation needs to use special processing for the non-ICAO addresses to avoid incorrect lookup and display of countries, aircraft registrations etc. There is no way for BaseStation to determine the country for a non-ICAO address, and there is no guarantee that such an aircraft or ground vehicle will consistently use the same address.

As the database currently uses a fixed 6-character field for the aircraft address, BaseStation distinguishes non-ICAO addresses by modifying the first character of the displayed hex code as follows:

0 -> G

1 -> H

2 -> J

3 -> K

4 -> M

5 -> N

6 -> P

7 -> Q

8 -> R

9 -> S

A -> T

B -> U

C -> V

D -> W

E -> X

F -> Y



This means that the code does not conflict with the existing ICAO addresses in the database, while still fitting within the 6 character aircraft address field.

For the ModeA/Track number addresses (used by TIS-B only) the last digit is modified instead.

The setting **Output Non-ICAO Addresses** enables these aircraft to be output to the data port for use by third party applications. Leave this option unchecked if the application cannot handle the modified 6-character codes.

The setting **Save Non-ICAO Addresses to DB** enables saving of aircraft with these addresses to the database. Again, you can leave this option unchecked if the database is used by a third party application that cannot handle the modified 6-character codes.

**Timeouts (Seconds):** These parameters dictate how the application responds when it stops receiving messages from an aircraft.

If a preset number of seconds (configured using the *Position Lost* box) has elapsed since the time the last message was received, the aircraft changes to a state of "position lost", and is shown as yellow (by default) on both the Radar Screen and in the Aircraft List.

If a further period (set by the *Signal Lost* box) elapses without receiving a message, the aircraft changes to a state of "signal lost" and is removed from the Radar Screen and shown as red in the Aircraft List.

If a further period elapses without receiving a message (configured in the *Remove* box) then the aircraft is removed from the Aircraft List.

When a final period (set by the *Delete* box) has elapsed, the aircraft's data is purged completely from memory.

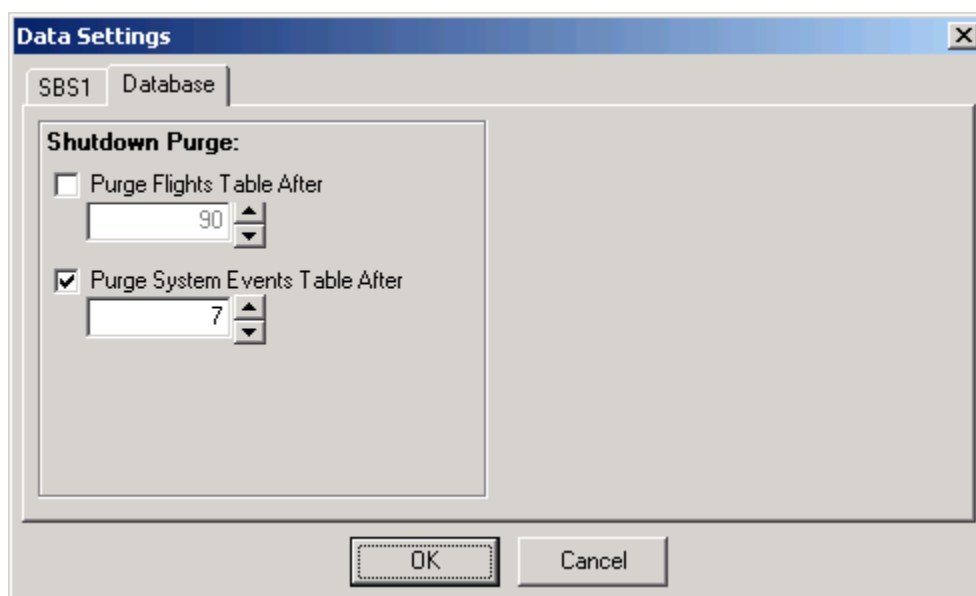


Figure 29: The Data Settings dialog box (Database tab)

On the **Database** tab, BaseStation can be set to purge (delete) data over a certain age each time it shuts down. It can do this for both the *Flights* and *System Events* tables. By default, it leaves the *Flights* table alone, but will delete all records in the *System Events* table that are more than 7 days old.

### 3.3.5.3 Hardware Settings

This menu option brings up the *Hardware Settings* dialog box:

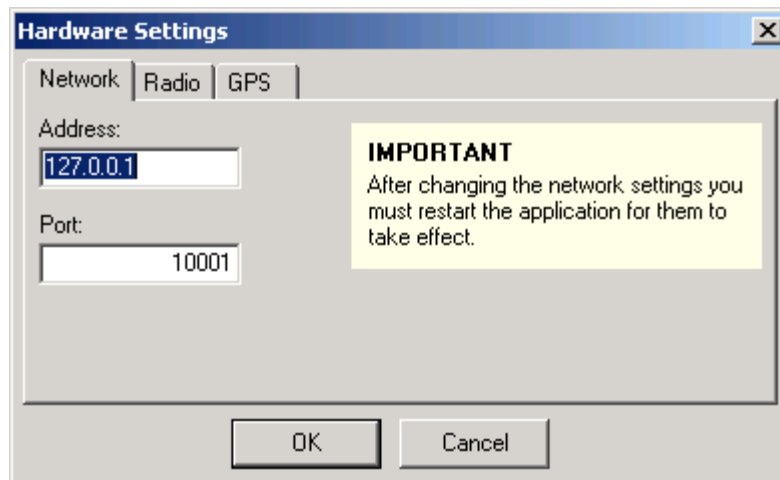


Figure 30: The Hardware Settings dialog box (Network tab)

The **Network** tab is relevant only if you have an SBS-3, SBS-1eR, SBS-1e or an SBS-1EM add-on Ethernet module for your SBS-1. If you do, then enter the IP address it has on your network and the port that you use to connect to it (which will usually be 10001).

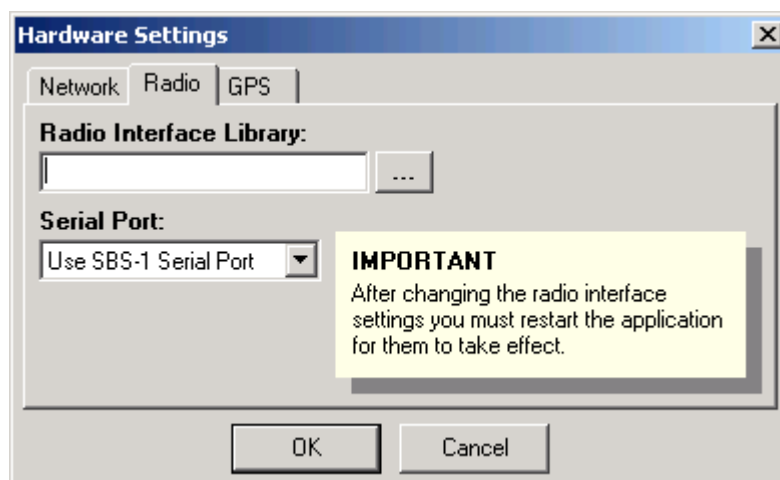


Figure 31: The Hardware Settings dialog box (Radio Tab)

The **Radio** tab is used to configure the external radio interface (see chapter 3).

The *Radio Interface Library* setting allows you to select a *BaseStation Interface Unit* (.BIU) file that implements an interface to the radio (scanner) that you use.

☞ Selecting an interface file will cause the Radio menu to appear in the main application menu bar.

The *Serial Port* drop down box allows you to select between having the external scanner connected to your PC's serial port (the standard option) and the SBS unit's serial port (useful when your PC does not have a serial port).

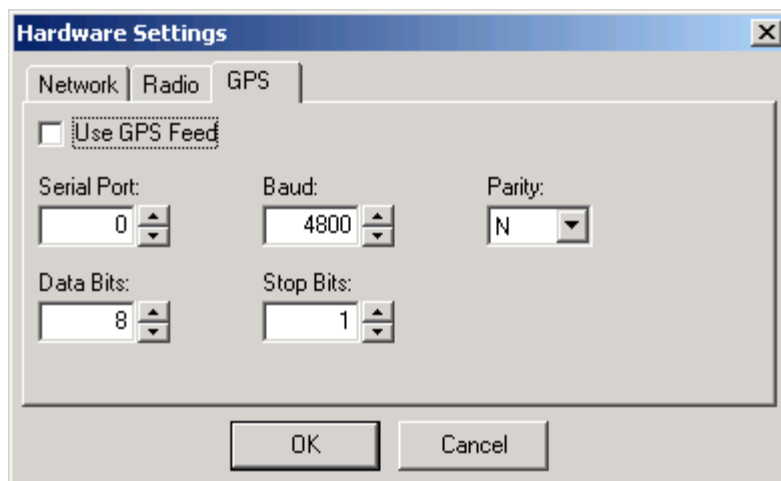


Figure 32: The Hardware Settings dialog box (GPS tab)

The **GPS** tab allows you to configure the system to use an attached GPS unit to provide location data to BaseStation.

- The GPS unit must output standard NMEA data to a serial port on the PC (or a USB port configured to emulate a serial port).

To enable the use of GPS, simply check the *Use GPS Feed* checkbox, and then enter the appropriate values into the edit fields below.

Once this value is checked, a GPS status panel will appear on the status bar (you have to restart BaseStation for this to occur), and a *GPS Status* menu option will become visible in the *Settings* menu.

Whenever the GPS unit is providing valid data (i.e. it has a fix – see the *GPS Status* menu option for further details), the latitude and longitude coordinates that it is outputting (i.e. your current location) will be used in preference to the coordinates of the currently selected location. This applies when you have opted to centre the range rings on the current location (GPS location will be used instead) and when you have opted to have range and bearing lines drawn from the current location (GPS location will again be used).

The **Audio** tab has settings relating to digital audio streaming from the built-in radio on the SBS-3, SDR Puck or SBS-1eR. These settings are described in the section on Using the Built-in Radio.

#### 3.3.5.4 Install Firmware Option

Clicking on this menu item brings up the following dialog box:

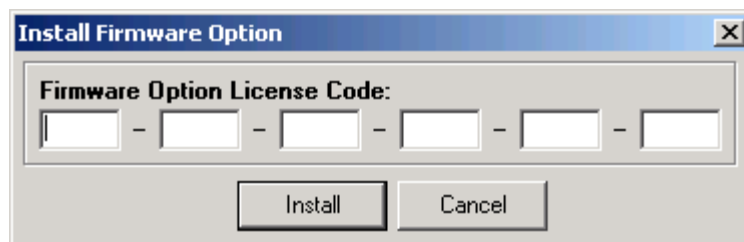


Figure 33: The Install Firmware Option dialog box

This menu item is used to enter Firmware Option License Codes into the SBS-3, Puck or SBS-1 family device to activate any future features that are sold as separate options. Instructions for doing this will be included in any such feature packages that you purchase.

#### 3.3.5.5 Data Source

This menu item has two options: *Use USB* and *Use Network*. You should select *Use Network* only if you have an SBS-3, SBS-1eR, SBS-1e or an SBS-1EM add-on Ethernet module for your classic SBS-1, and have configured its use via the Network tab of the Hardware Settings dialog box. If all of these conditions apply, then you can toggle between using USB and using the network by clicking on the corresponding option in this sub-menu.

#### 3.3.5.6 Locations Manager

Clicking on this item brings up the following dialog box:

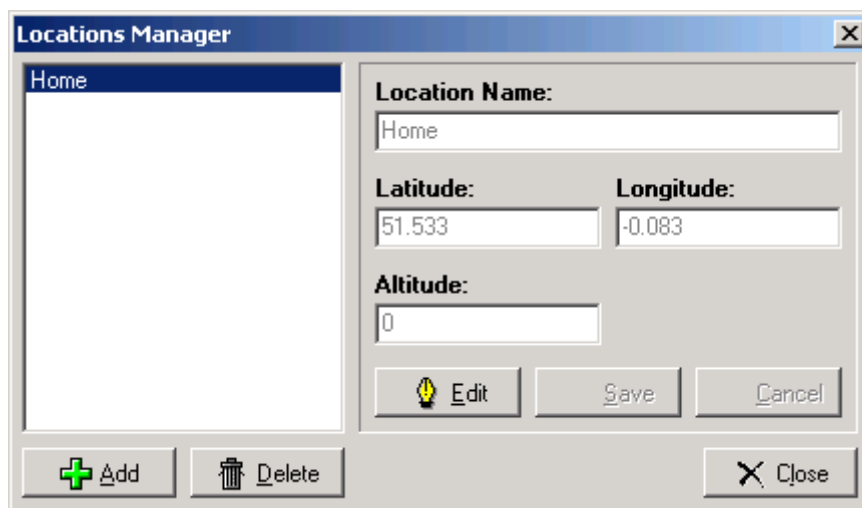


Figure 34: The Locations Manager dialog box

The Locations Manager allows you to define the positions from which you intend to use BaseStation. By default, you will have one location defined called "Home", which will have the latitude and longitude value that you entered into the Startup Configuration wizard.


If you use BaseStation in a different location, then you can either edit the values of your Home location or create an additional location.

To add a new location, simply click on Add, enter the location name, the latitude, the longitude and the altitude (can be zero) and then

click on save. To edit an existing location, select it, click on edit, change the required details, and click on save. To delete a location, select it and click on delete.

- You cannot delete a location that has been used while you were recording data. This is because there are flights in the database linked to that location. You can only delete a location if you have not yet used it.

For more details on location, including how to set the current location, please see the section on the Current Location Selector in the Toolbar chapter.

- ☞ The Locations Manager can also be opened by clicking on the toolbar button 

### 3.3.5.7 GPS Status

This menu item appears only if BaseStation has been configured to receive position data from an external GPS unit attached on a serial port (See Hardware Settings Menu, GPS tab). Clicking on this item brings up the following dialog box:

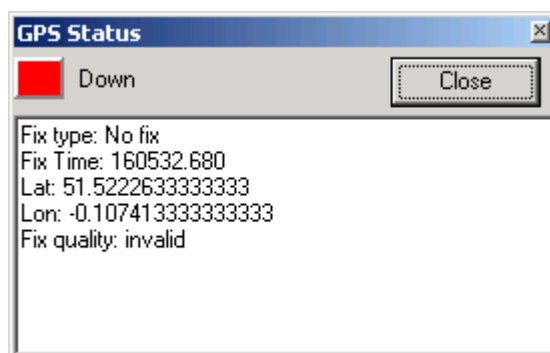


Figure 35: The GPS Status dialog box

This floating window shows the current status of the GPS connection. It can have three states:

**Off:** This indicates that BaseStation is not receiving any messages from the GPS unit (for example if it is turned off or disconnected). This is shown as dark red in both this dialog box and on the status bar.

**Down:** This means that BaseStation is receiving messages from the GPS unit, but that those messages are telling BaseStation that the GPS unit is not currently able to obtain a fix to determine its location. This is shown as bright red in both this dialog box and on the status bar.

**Up:** This means that the GPS has informed BaseStation that it is now fully operational and delivering valid coordinates. This is shown as bright green in both this dialog box and on the status bar.

### 3.3.5.8 Toolbars

This menu item brings up a sub-menu allowing you to hide or show individual parts of the toolbar.

### 3.3.5.9 Status Bar

This menu option allows you to hide or show the status bar.

### 3.3.5.10 Sidebar

This menu option allows you to hide or show the sidebar.

### 3.3.5.11 Reload

*Reload Outlines* causes all outlines to be reloaded. You would normally only do this if you have modified an existing outline file or added a new one.

*Reload Waypoints* causes all waypoints to be reloaded. You would normally only do this if you have modified an existing waypoint file or added a new one.

*Reload Flags* causes the country definition file *countries.dat*, plus all country and operator flags to be reloaded. You can use this if you have modified or added flag bitmap (.BMP) files.

### 3.3.5.12 Hide Main Window

When using an SBS-3 or SDR Puck, Basestation can be used without the main (radar display) window, which may be hidden using the Settings>Hide Main Window menu option. Selecting this option in effect makes the SDR Control Panel the main window of the application, with a limited set of menu items.

Please refer to section 4.1 of this manual for instructions on using the SDR Control Panel.



You can also use the keyboard shortcut Ctrl-Alt-W.

### 3.3.6 Help Menu

#### 3.3.6.1 Reference Manual

This menu option displays the PDF file containing the BaseStation Reference Manual (this document).

#### 3.3.6.2 Release Notes

This menu option displays the release notes for installed version of the BaseStation application.

#### 3.3.6.3 BaseStation Websites

This submenu can launch (in your default browser) various BaseStation related web sites that can be used to get help and information about the BaseStation software and SBS-3, Puck and SBS-1 family products.

#### 3.3.6.4 User Websites

This submenu can launch websites that are not connected with the BaseStation software but might be of interest to users.

☞ Toolbar button 

#### 3.3.6.5 About BaseStation

This menu option launches an *About* dialog box that displays various information, including the version number of your BaseStation software and the firmware version installed in your SBS or Puck device. It also lists any firmware options you have installed.



## 3.4 Aircraft List

### 3.4.1 What The Aircraft List Shows

The Aircraft List has an entry for each aircraft that BaseStation is currently receiving messages from.

The **Status** column shows the transmission status of the aircraft by means of colour-coded symbols. Green indicates that transmissions are being received from the aircraft. Yellow indicates that more than 30 seconds have gone by without receiving a transmission. Red indicates that 35 seconds have gone by without receiving a transmission.




☞ These timeouts can be changed using the *Settings > Data Settings* menu item. The colours can be changed using the *Settings > Display Settings* menu item.

If the symbol is an aircraft then it indicates that ADS-B messages that contain latitude and longitude data are being received from this aircraft.

If the symbol is a solid circle (●) then this indicates that ADS-B messages are being received from the aircraft, but that they do not contain latitude and longitude data.

If the symbol is four diamonds (❖) then this indicates that only Mode-S messages are being received from the aircraft (but no ADS-B messages).

The **State** column uses colour coded arrows to indicate whether the aircraft is:

- Ascending: a thick, upward pointing blue arrow 
- Descending: a thick, downward pointing brown arrow 
- Flying straight and level: a thick, horizontal blue-green arrow 
- On the ground: a horizontal arrow as for flying straight and level, but thin and grey.

The **Show Trail** column indicates whether or not the aircraft is being individually tracked. A tick indicates that it is.

The **Flag** column displays the flag corresponding to the country of the aircraft (see the Country field below).

The **Operator Flag** column can be used to display a graphic for each aircraft, typically to show its operator. Operator flag graphic files must be in .bmp format and must be placed in an OperatorFlags subdirectory. To set an aircraft to display the operator flag, enter the name of the file minus the .bmp extension into the *Operator Flag*

Code field of the Edit Aircraft Details dialog box in the Aircraft Details Window.

For example, if you enter "BAW" into the OperatorFlagCode field of an aircraft, and you have previously placed the file *BAW.bmp* into the folder *(Installation path)\OperatorFlags*, then the bitmap from *BAW.bmp* will be displayed in the Operator column for that aircraft.

☞ Third party applications may be used to populate operator codes in the database.

The **Interested** column displays a symbol if the aircraft has been marked as one that you are interested in. See the description of the *Aircraft > Show Only Aircraft Marked Interested* menu item for more details.

The **Code** column shows the 24-bit Mode-S address of the aircraft. It is displayed as six hexadecimal digits. A range of addresses is assigned to each country by ICAO, and the country then assigns addresses within its allocated range to aircraft registered there. The address code is used by BaseStation to identify individual aircraft uniquely.

The **Callsign** column shows the call-sign identification of the flight. This is sent by the aircraft in ADS-B messages.

The **Registration** column shows the registration mark of the aircraft. This can be set for each aircraft using the Registration field in the Aircraft Details Window or a third party database population tool.

The **User Tag** column contains user text that can be set for each aircraft using User Tag field in the Aircraft Details Window.

The **ICAO Code** column shows the ICAO operator code of the aircraft. This can be set for each aircraft using the Operator Flag Code field in the Aircraft Details Window or using a third party database population tool. This code is used also by BaseStation to determine which bitmap to display in the Operator Flag column.

The **Country** column shows the country of registration of the aircraft. This is determined automatically by BaseStation from the Mode-S address of the aircraft using information in the file *countries.dat*.

The **Altitude** column shows the altitude that was last reported by the aircraft. By default this is displayed in feet but may optionally be displayed as a *flight level*. See the *Settings > Display Settings* menu for details.

☞ Aircraft on the ground do not report their altitude in ADS-B messages, and will be displayed with an altitude of zero.

The **Latitude** and **Longitude** columns display the last reported position of the aircraft, if any.

The **Speed** column shows the aircraft's ground speed, in knots, if reported. Not all ADS-B equipped aircraft report their velocity over the ground.

The **Track** column shows the track angle of the aircraft over the ground, in degrees, if reported.

The **Vertical Rate** column displays the rate of climb (or descent if negative) of the aircraft in feet per minute. Not all aircraft report this information.

The **Squawk** column shows the "squawk" code, if any, that the aircraft is transmitting (this is also known as the Mode A or Mode 3 code). This is a four digit code where each digit is in the range 0 to 7, giving 4096 possible codes. Under certain circumstances, the squawk code will be displayed with a symbol after it. The possible symbols are:

\* (Ident): Transmitted when the pilot presses the "Ident" button in response to a request from Air Traffic Control. Normally transmitted for 18 seconds.

+ (Alert): Transmitted when the squawk code changes (usually for 18 seconds).

**E** (Emergency): Indicates that the squawk is one of a number of internationally agreed codes defined to indicate an emergency. These include 7700 (emergency condition), 7600 (radio failure) and 7500 (unlawful interference).

The **Last Update** column displays the time that the last message was received for that aircraft.

The **Time Tracked** column shows the time that has elapsed since the first message was received for the aircraft.

### 3.4.2 Using The Aircraft List

To select an aircraft, simply click on that aircraft's row. You can move the selection up and down by using the arrow keys.

Initially, the Aircraft List is sorted on **Last Update**. This means that as new aircraft appear, their rows are inserted in at the top, with the existing rows shuffling down.

To sort on a different column, simply click on that column's heading. The column that is the current sort column is drawn depressed as an indicator, and has an arrow showing the direction of sort. (Some columns default to ascending, others to descending). You can toggle the direction of sort by clicking a second time on the heading.

You can toggle the "show track" status of the currently selected aircraft with the space bar.

Double-clicking on the Aircraft List will bring up the Aircraft Details window. Once that is visible, it will display the details of whichever aircraft is selected.

Finally, right-clicking on the Aircraft List will display a pop-up menu containing the menu options that particularly apply to the Aircraft List.

The Show All button determines which aircraft are shown on the aircraft list. It duplicates the functionality of the "*Show All Aircraft (Inc. Non Position)*" menu item in the Aircraft menu (see the description of that item for details).

The *Int Only* button also determines which aircraft are shown on the aircraft list. It duplicates the functionality of the *Aircraft > Show Only Aircraft Marked Interested* menu item (see the description of that item for details).

### 3.4.3 Customising The Aircraft List

You can change the width of the columns by clicking on the dividing line between two column headings and dragging it to the left or right with the mouse.

You can opt to hide or display certain columns using the Columns submenu of the Aircraft menu.

## 3.5 Toolbar

Most of the items on the toolbar are duplicates of commonly used menu items, and are described in the section above. However, there are four items that are unique to the toolbar, and are described in this section.

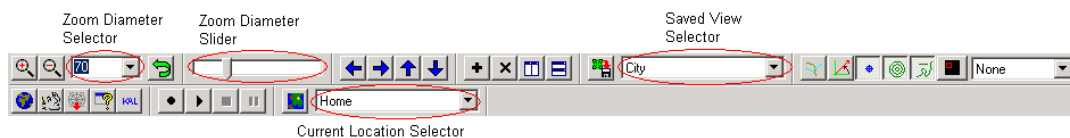


Figure 36: The BaseStation toolbar

### 3.5.1 Zoom Diameter Selector

Popping this down offers a range of specific zoom diameters (the width, in nautical miles, of the real-world area covered by the radar scope range rings) to set the current view to. You can also type in a specific number.

### 3.5.2 Zoom Diameter Slider

This offers an alternative way to zoom in and out. Simply slide to the left to zoom in, and to the right to zoom out.

### 3.5.3 Saved View Selector

This allows you to select a previously saved view to apply to the current view. The current view (zoom diameter, zoom centre and display toggle settings) will change to the settings saved in the saved view.

### 3.5.4 Current Location Selector


This allows you to change which of your previously defined locations is the one you are currently at. Setting the correct location is important for a number of reasons:

- The system will use the correct current latitude and longitude when decoding messages picked up from aircraft on the ground, thus ensuring that their positions are correctly decoded. This is because aircraft on the ground do not transmit their full global position in the ADS-B messages, so decoding the correct position relies on knowing the location of the receiving unit, and the assumption that the aircraft will be within a few hundred miles of the receiver.
- If you later browse the flight in BaseStation Reporter you will be able to see the location from which the aircraft was detected.

- If you use BaseStation Logger to log the data messages received for later analysis, you will be able to distinguish between messages received from different locations.

☛ To display aircraft on the ground correctly, their true position must be within approximately 45 degrees of latitude and 45 degrees of longitude from the currently selected location.

For more information about locations, see the entry for the Locations Manager under the Settings menu.

☞ The Locations Manager can also be opened by clicking on the toolbar button  next to the current location selector.

☞ You might typically change the location if you run your system on a laptop and are using it outside your home.

☞ When you change the current location, it is changed for the entire session. If you started BaseStation at 9:01 am and at 9:03 am change the location, the software assumes that you've been at that new location since you started up.

## 3.6 Sidebar

The sidebar offers duplicates of some of the controls in the main toolbar, plus one unique control: the Full Screen button.

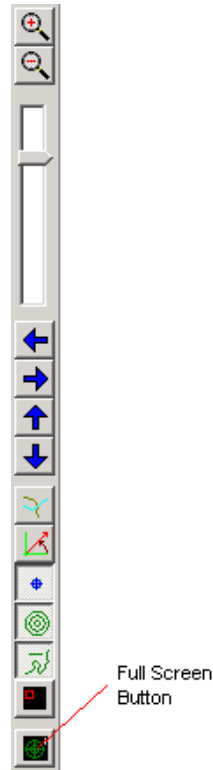


Figure 37: The BaseStation side bar

Clicking on the Full Screen button puts the application into full screen mode. In this mode, the application occupies the entire screen (including the area where the taskbar would normally be) and all controls except for the sidebar and the radar screen are hidden (i.e. no menu, no toolbar, no status bar and no aircraft list).

This mode is ideal if you want to concentrate on the Radar Screen alone without any distractions.

To get out of full screen mode, simply click on the Full Screen button again.

- ☞ Full screen mode can also be toggled by pressing Ctrl-Alt-F or via a popup menu by right clicking on the radar screen.

## 4 Radio Interfaces

### 4.1 Using the SDR Receivers on the **SBS-3** and **SDR Puck**

#### 4.1.1 What is Software Defined Radio ?

With Software Defined Radio (SDR), instead of using dedicated hardware to allow reception of say AM or FM radio stations, the incoming radio signal is digitised and then processed in real time by software to extract the desired audio or data. This means that different features or types of processing can be added without needing to change the hardware.

#### 4.1.2 Introduction to SDR on the SBS-3 and SDR Puck

The SBS-3 has two Software Defined Radio (SDR) tuners, called tuner A and B. The SDR Puck has tuner A only.

Each of these digital tuners can receive a continuous frequency span (bandwidth) of 8 MHz.

The centre frequency of each tuner's frequency span can be set anywhere within the range 27 MHz to 980 MHz, and they may overlap.

There are then six independent SDR demodulator channels within the SBS-3 or SDR Puck, called SDR 1 to 6, which can process the digitised data from the two tuners. This allows up to 6 stations to be "picked out" simultaneously from the two 8 MHz tuner spans.

Each SDR channel can be tuned to any frequency within the tuned span of either tuner A or B. The demodulation type for each channel can be set independently to AM or FM. These demodulate the narrow band transmissions typically used in the aircraft, marine and other communications bands. SDR Channel 1 can also be set to Wideband FM mode for receiving FM broadcast radio transmissions, or the sound channels of analog terrestrial TV.

Each SDR channel can be used to decode ACARS data from aircraft if tuned to a suitable VHF frequency. This allows up to 6 ACARS channels to be decoded simultaneously.

SDR channel 6 can be used to decode AIS marine data. It can decode both AIS channels (161.975 MHz and 162.025 MHz) simultaneously using only one SDR channel.

In the future it is expected that other types of demodulation will be supported.

Because they incorporate true SDR, the SBS-3 and SDR Puck have no restrictions to the types of demodulator that can be implemented,



or number of channels that can be received, other than the practical limits set by the hardware resources in the FPGA.

Kinetic may in the future offer different firmware sets allowing various combinations of features (such as number of channels and demodulators) to suit particular environments.

### 4.1.3 Using the SDR Control Panel

The SDR features are accessed by a Control Panel. This is a separate window within BaseStation that can be launched either by using the "Built-In SDR" - "Control Panel" menu item, or by clicking on the Control Panel toolbar button, which is the leftmost button on the built-in SDR toolbar:



Figure 38: The Built-in SDR Toolbar

- ☞ You can also use the keyboard shortcut Ctrl-Alt-P to launch the Radio Control Panel.

If the Built-in SDR toolbar is not visible, it can be enabled by using the "Settings" - "Toolbars" menu.

If the external radio interface is also enabled then both sets of buttons will appear:



Figure 39: The Radio Toolbars With Both Radios Enabled

The external radio interface is described further in the next section.

- ☞ The other items on the Built-in SDR toolbar and menu can be used to control certain features of the radio without opening the control panel. You can use them to tune to a frequency from BaseStation's database, or alter the master volume and mute settings. See the section below on Using the Built-in SDR Toolbar and Menus.

#### 4.1.3.1 Controlling the Tuners

The top part of the SDR control panel concerns the two tuners, A and B. There is a frequency display for each tuner, and below the two displays there is a slider bar.

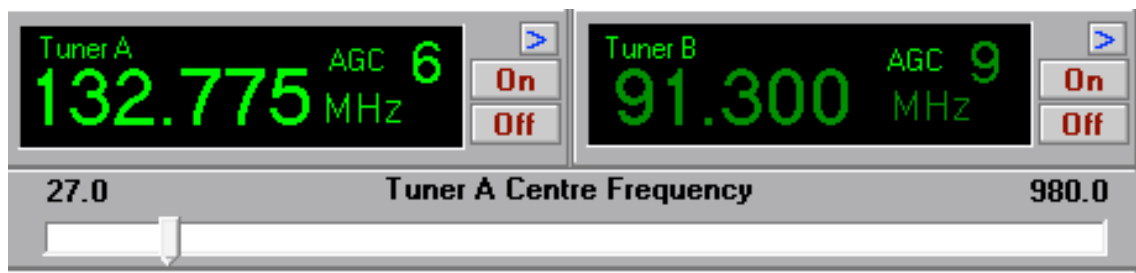


Figure 40: The Tuner Control Panels

Each tuner can be turned on or off using the buttons on the left side of the corresponding panel. Initially they will both be turned off and the frequency display will show "Off".

Once a tuner has been turned on, its centre frequency can be set and will be displayed in the corresponding tuner panel. This frequency can be set using either the slider bar or a pop-out keypad.

The slider bar can be used as a coarse control to set the centre frequency for the currently selected tuner. This is the tuner whose frequency is shown in bright green (Tuner B in the example screen shot).

Alternatively you can enter a frequency using a pop-up keypad. To bring up the keypad, click on the ">" key at the right of the tuner display for which you wish to enter the frequency. Clicking on the ">" key again hides the keypad, or you can click on the ">" key for a different tuner, and the keypad will move to that tuner.



Figure 41: The Frequency Keypad

Click on the keys (or use the PC's keyboard) to enter the required frequency and then press Enter.

Remember, each tuner can capture an 8 MHz band within the radio spectrum. So for example if you are interested in some stations in the lower part of the aviation AM voice band, you could tune the centre frequency of one of the tuners to 122 MHz and that would enable you to receive channels between 118 and 126 MHz.

As another example, selecting a centre frequency of 160 MHz would cover the international marine FM band, between 156 and 164 MHz.

- ☞ The centre frequency for each tuner must be within the range 27 MHz to 980 MHz. If you set a frequency outside this range, the frequency display will change to red.
- ☞ The Automatic Gain Control (AGC) display for each tuner shows the current amount of signal attenuation within each tuner. This is displayed in units of decibels (dB). A value of 0 means no attenuation. The reason for attenuating the signal is if there is a strong transmission within or near that tuner's frequency span that would otherwise overload the tuner or the analog to digital converter.

#### 4.1.3.2 Controlling the SDR Channels

Below the two tuner displays and associated slider, there is a panel for controlling each of the six SDR channels, SDR 1 to 6.



Figure 42: SDR Control Panel

For each SDR channel there are buttons for selecting the tuner source, A or B. Then you can use the slider bar below to select the required frequency from the 8 MHz span of that tuner. The slider bar operates on the currently selected SDR channel - the one with the bright green display - the other three channels will have a darker green display. You can select a channel by clicking within the corresponding panel. The end points of the slider bar will change according to span of the selected tuner.

Alternatively as before, you can bring up the pop-up keypad to enter a frequency, by clicking on the ">" button at the right of the SDR panel.

These channels may be placed anywhere within the 8MHz spans of either tuner A or tuner B or both.

- ☞ If you set a frequency outside this range, i.e. more than 4MHz away from the centre frequency of the tuner, the SDR channel's frequency display will change to red.

As well as the frequency, you can set the modulation type for the SDR channel, AM or FM. Just click on the corresponding button at the left of the panel.

- ☞ SDR1 also has WFM, allowing listening to broadcast FM and the sound channels of terrestrial analog TV, etc.

For each SDR channel the Received Signal Strength Indication (RSSI) is displayed. This is a number indicating the relative strength of the radio signal being received on that channel. A difference of one in the displayed number represents a difference of approximately 1dB in the received signal power. At the same time, a bar indicator to the right gives a rough visual indication of signal strength.

There is also a slider control to adjust the squelch.

When squelch is active, the colour of the signal strength indicator bar changes to red.

- ☞ You should adjust the squelch level so that the output is squelched (muted) when no transmission is taking place, so that you do not hear continuous noise in the background. When the RSSI increases above the set squelch level, the audio will be un-muted automatically. Finally, there is an individual mute button for each SDR channel. As a reminder, a red "Mute" indication is displayed when the channel is muted.

#### 4.1.3.3 An Example of Using the SDR's

You want to listen to London Volmet on 128.6 MHz and Gatwick Radar on 126.825 MHz, and also to two FM marine channels on 156.7 MHz and 161.3 MHz.

You can do this because the four frequencies fall within two 8MHz bands.

At the top of the control panel stack, you could set the centre frequency of tuner A to 127MHz. This gives tuner A a range of 123MHz to 131MHz. Then you can set SDR 1 to 128.6 MHz AM, and SDR 2 to 126.825 MHz AM.

Now set the centre frequency of tuner B to 160MHz. This gives tuner B a range of 156MHz to 164MHz which spans the international marine band. Then set SDR3 to 156.7 MHz FM, and SDR4 to 161.3 MHz FM.

The audio mixer panel is then set to enable these SDRs on the left and/or right channel as required (see the Audio Mixer section).

Finally don't forget to set the squelch levels for each SDR channel as required using the slider bars.

#### 4.1.3.4 Frequency Presets

BaseStation can store up to 100 preset frequencies for the internal radio. These are accessed using the preset buttons which appear below the pop-up frequency setting keypad, whenever it is adjacent to an SDR channel.

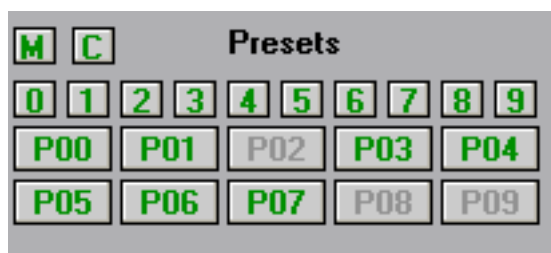


Figure 43: Preset Buttons

To listen to a preset frequency, simply click on the required preset button. Preset buttons with a frequency stored are shown in green, unused presets are shown greyed out. The presets are displayed in banks of 10, and you can switch between banks using the smaller green buttons labelled 0 to 9.

The display on the SDR channel changes to show the preset frequency and modulation type.

- 👁 If the SDR channel goes out of range of the 8MHz bandwidth of its associated tuner when a preset frequency is applied, then the tuner will be adjusted to centre on the new frequency, making it a one-step operation to tune to the selected frequency using a preset button.
- 👉 If you selected the frequency originally from the BaseStation frequency database, then the SDR display will also show a description of this frequency (for example "EGLL-TWR"). You can also manually edit this description by using the "Set Name" button on the pop-up keypad, before storing the frequency as a preset.

To store a frequency you are tuned to on the SDR, click on the green M button and then the desired preset button: P00, P01 etc. Unused presets are shown in brown and used presets are shown greyed out after you click on M.

To clear a preset, click the green C button followed by the preset button.

#### 4.1.4 Using the Audio Mixer

The Audio Mixer window is launched from the SDR menu.

- 👉 You can also use the keyboard shortcut Ctrl-Alt-M.

The window has two comprehensive audio mixer panels. The upper panel controls the SBS-3's analog outputs (the standard 3.5 mm stereo audio jack socket located on the rear of the SBS-3). You can listen to this output using external speakers or headphones. This feature is not available on the SDR Puck.

The lower panel is for the digital output stream (transmitted to your PC or other equipment over USB or Ethernet). You can listen to this using a media player application. Refer to the section in the BaseStation manual on Digital Audio Streaming.

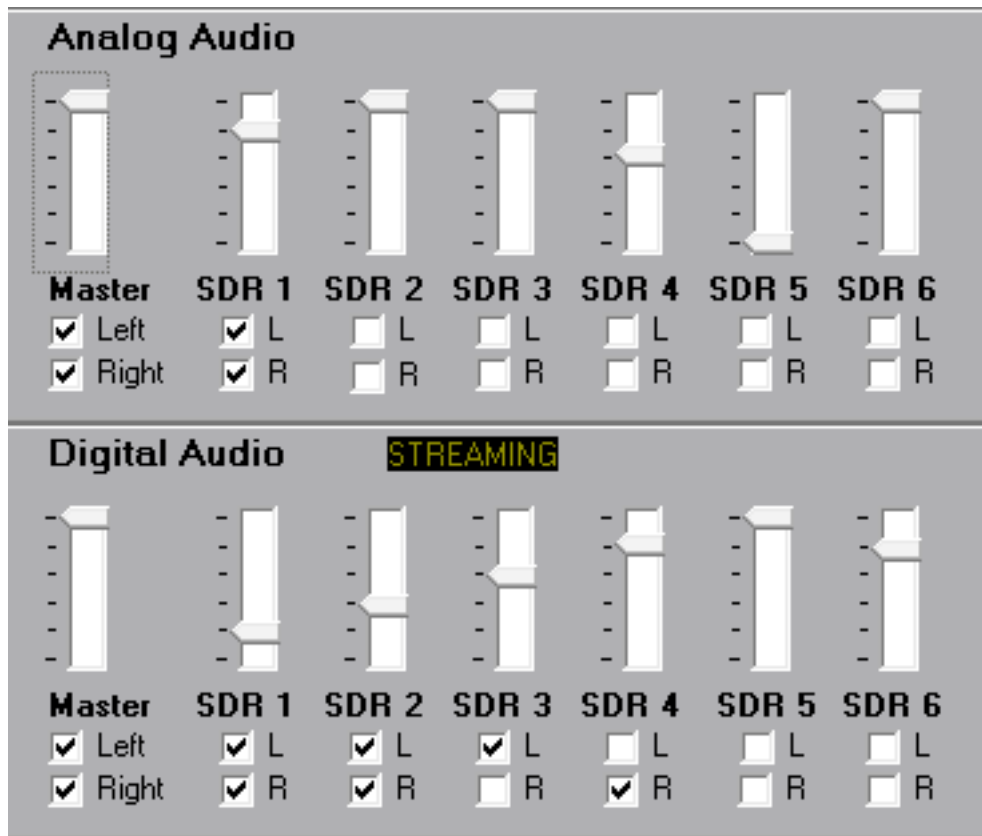


Figure 44: Audio Mixer Controls

On the left of each mixer panel, there is an overall master gain (volume) slider control for the output, with the topmost setting being the maximum.

Below this are master check-box controls for the left and right output channels. Checking a box enables the output, unchecking it mutes the output.

To the right are controls that select which of the SDR channels are combined to generate the audio output. If a box is checked, then that channel's audio is enabled.

☞ You can enable the left and right channels separately, so that for example you could listen to one SDR channel (or combination of channels) in your left ear and another in your right ear.

You can also adjust the relative gain (volume) for each SDR using the slider controls. For example a channel with infrequent transmissions but a high importance might be set to the maximum level and other channels to a slightly lower level.


#### 4.1.4.1 Audio Streaming Indicator


BaseStation generates a digital audio stream from the built-in SDR, for use by third-party applications. When such an application is connected, the STREAMING indicator on the Digital Audio section of


the mixer window appears “lit” in bright yellow. When no streaming is taking place, it appears in dull yellow.

## 4.1.5 Using The Built-In SDR Toolbar and Menus

### 4.1.5.1 SDR Toolbar

 Pressing this button makes the SDR Control Panel appear. Pressing it again makes it disappear.

 Pressing this button brings up a menu which allows you to select any frequency in BaseStation’s radio frequency database. If you select a frequency from this menu then the SDR channel currently highlighted on the control panel will be tuned into that frequency. The control panel itself does not have to be visible to use this feature, however.


 If the SDR channel goes out of range of the 8MHz bandwidth of its associated tuner, then the tuner will be adjusted to centre on the new frequency, making it a one-step operation to tune to a frequency using the menus.

Note: BaseStation comes with frequencies for the UK. You can add more frequencies to the .rfq files in the *RadioFrequencies* subdirectory. Details of how to do this are available on the Kinetic forums.

 Pressing this button mutes or un-mutes the sound.

 Pressing this button increases the volume.

 Pressing this button decreases the volume.

 The toolbar mute and volume control buttons operate on the master mute and gain settings of both the analog and digital channels at the same time.

### 4.1.5.2 Built-in SDR Menu

The top part of the Built-in SDR menu allows you to turn the currently selected tuner on and off or select AM or FM demodulation on the currently highlighted SDR channel.

The remaining menu items are equivalent to the items in the radio toolbar above.

### 4.1.5.3 Local Frequencies Right-Click Popup

You can right-click anywhere on the radar display and select “*Local Frequencies-Built In Radio*” from the resulting pop-up menu to get a list of the radio frequencies in use in that area. For example, clicking somewhere between Heathrow and Elstree would produce the following menu:

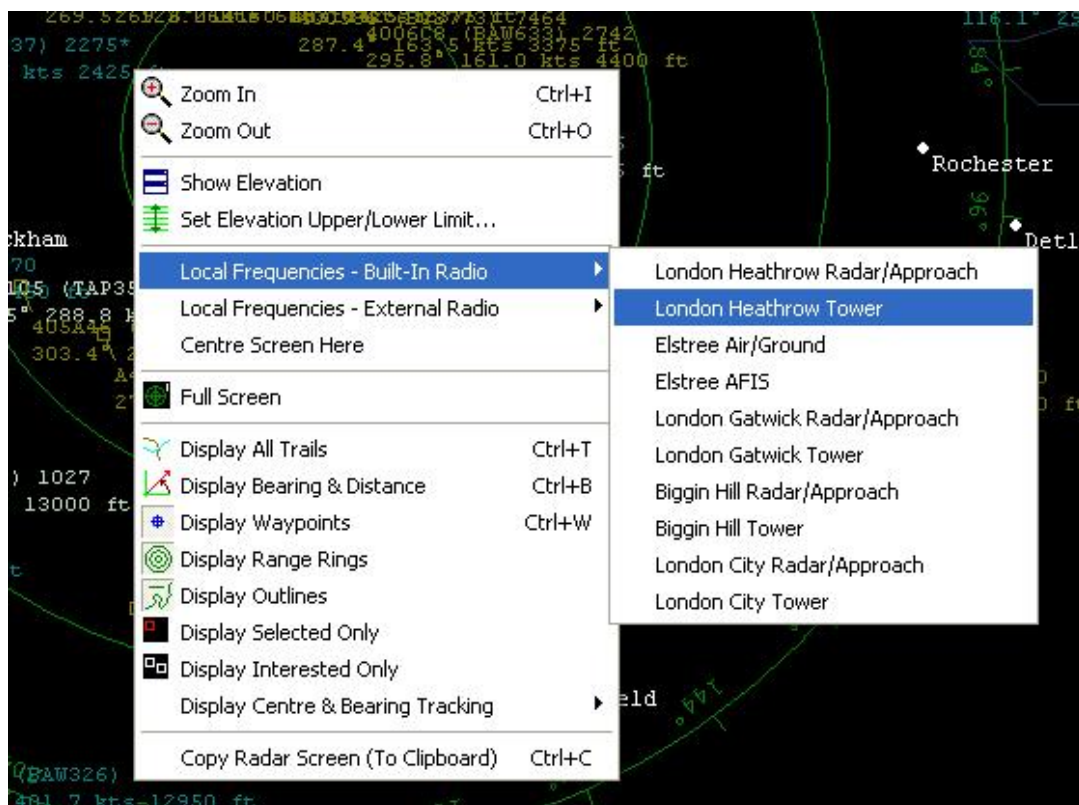


Figure 45: The Local Frequencies submenu

The frequencies are sorted in order of the waypoints that they are associated with.

Simply click on the desired frequency from the list to tune the currently highlighted SDR channel to that frequency.

The built-in SDR channels and external radio can each be tuned to separate frequencies for maximum flexibility.

#### 4.1.6 Receiving ACARS messages

The SBS-3 or SDR Puck's built-In SDR can be used to receive messages sent by aircraft using the Aircraft Communications Addressing and Reporting System (ACARS). These are text messages containing operational information about the aircraft, and are sent over certain VHF air-band channels. Each of the SDR channels can be used to decode a different ACARS channel simultaneously, allowing up to 6 frequencies to be monitored.

To decode ACARS messages, Set one of the two tuners to 133.0 MHz, as ACARS channels are in the upper part of the VHF air band.

Then tune the required SDR channels to your local ACARS frequencies. The frequencies used vary throughout the world but the following frequencies are currently used in Europe:

131.525 MHz	131.725 MHz
131.825 MHz	136.750 MHz



Please ensure that the SDR channels to be used for ACARS are set to AM demodulation. Please also note that the squelch level should be set to zero and the SDR channel itself should not be muted (although the audio output can be turned off for the channel on the mixer panel as required).

#### 4.1.6.1 The ACARS Message Window

BaseStation will display any ACARS messages received in a special window which is displayed using the *Built-in SDR - ACARS Window* menu item.

☞ You can also use the keyboard shortcut Ctrl-Alt-A.

Date	Time	Frequency	Mode	Registration	Mess	Blo	Sequer	Flight Num	Message Text
25/09/2012	17:17:44	131.825	2	EI-DES	H1	1	D45D	EJ043F	#DFB222222G11/
25/09/2012	17:17:56	131.725	E	G-EUKI	15	9	M13A	BA0475	FST01LEBLEGLLN050358w0013181218 39 50 3C 43232 430 16381618
25/09/2012	17:17:57	131.725	E	HL7491	J	4	S59A	KE0907	
25/09/2012	17:18:06	131.525	R	G-EUPE	15	5	M83A	BA33CE	FST01LFMNEGLLN051490w0000204 55 33 42PS002 219 5750 1623161
25/09/2012	17:18:09	136.750	T	G-EUDH	15	8	M73A	BA002P	FST01EGLLEGCCN051495w0005051 23 37 6 1C 24206 157 16481618
25/09/2012	17:18:15	131.725	E	G-EUYA	J	0	S11A	BA0319	
25/09/2012	17:18:16	136.750	T	G-EUDH	H1	0	D06C	BA002P	#DFB01.00408.08000.239.097.0019.1.1/V203D01.00408.08000.247.100.0015
25/09/2012	17:18:18	131.725	E	G-EUYA	J	1	S12A	BA0319	
25/09/2012	17:18:26	136.750	T	G-EUPD	J	5	S48A	BA0336	
25/09/2012	17:18:27	136.750	T	G-EUPD	15	6	M90A	BA0336	FST01EGLLLFPON051501w0004352 10 50 5PS014 187 4750 17181618
25/09/2012	17:18:58	136.750	T	G-EUPD	H1	9	D11C	BA0336	#DFB01.00408.08000.224.094.0020.1.1/V203D01.00408.08000.272.096.0017
25/09/2012	17:19:12	131.525	R	G-DCCG	Q0	9	S48A	BA2944	
25/09/2012	17:19:18	131.725	G	HL7491	Q0	5	S60A	KE0907	
25/09/2012	17:19:20	131.825	2	G-EZDE	B9	5	M25A	U2589Y	/EGKK.T12/040EGKKA7673
25/09/2012	17:19:24	131.725	X	G-EUXC	J	2	S20A	BA012N	

Figure 46: The ACARS Message Window

The text and background colours on the window can be customised using the *ACARS* tab in the *Settings - Display Settings* menu. You can also choose whether to keep the window on top, and in which direction the messages scroll within the window.

**ACARS Display Colours:**  
Header:    
Background:    
Text:

**ACARS Log Files:** Start new file every  
☒ Enable Log Files  minutes  
  
D:\BaseStation\ACARS\ACARS

☒ Keep Window On Top  
☐ Scroll downwards

Figure 47: The ACARS Display Settings

☞ The columns on the ACARS Message Window can be resized by dragging the heading separator bars. The column sizes and window position are saved when BaseStation is shut down.

For each ACARS message, the following columns are displayed:

**Date**

The date that the message was received

**Time**

The time that the message was received

**Frequency**

Indicates which ACARS channel the message was received on

**Mode**

A single character indicating which ACARS mode is being used.

**Registration**

The registration mark of the aircraft that sent the message.

**Message Type**

A two-character code that identifies the type of ACARS message.

**Block ID**

A single character from 0 to 9 which is incremented for each new message. This allows repeat transmissions of the same message to be identified.

**Sequence Num**

Each new message has a different sequence number assigned to it. This also allows repeat transmissions of the same message to be identified.

**Flight Num**

The flight number of the aircraft that sent the message.

**Message Text**

The actual text of the message, if any. The format and content of this text will depend on the message type, and also on the airline and aircraft type that transmitted it. Many of the messages are generated automatically by the aircraft's computer systems, with information such as the aircraft's position or the status of its equipment, while others messages contain text sent directly by the crew.



Only those ACARS messages which pass a type of error check known as a CRC check are displayed. This reduces the possibility of displaying incorrectly decoded messages due to reception errors.

#### 4.1.6.2 ACARS Message Log Files

BaseStation can be configured to write the ACARS messages to CSV format log files. This feature is enabled from the *ACARS* tab in the *Settings - Display Settings* menu. You can select the file name and path for the log files - by default they are put into a folder named ACARS under the BaseStation folder.

You can also choose the duration of each log file in minutes. The default is one log file per day (1440 minutes). The date and time of the start of the log period will be added automatically to the file name.

While BaseStation is writing a log file, other applications are permitted to open the file for reading only.

#### 4.1.6.3 ACARS Data Output

Other applications can receive ACARS data from BaseStation over the network by opening a TCP connection on port 30008.

### 4.1.7 Receiving AIS messages

SDR channel 6 of the SBS-3 or SDR Puck Built-In Radio can be used to receive messages sent by ships and other marine stations using the Automatic Identification System (AIS). These messages can be used by a third party application such as ShipPlotter to display the positions of the ships.

To use this feature, SDR channel 6 should be set to FM and tuned to 161.975 MHz. This will allow both AIS channels (A and B) to be decoded. Please note that the squelch level should be set to zero and the SDR channel itself should not be muted (although the audio output can be turned off for the channel on the mixer panel as required).

If stand-alone operation of an SBS-3 is required, the radio settings can be saved in the SBS-3's non-volatile memory using the Built-In Radio tab of the Non-volatile Memory Settings menu option in BaseStation. The SBS-3 radio will then be initialised on power-up without the need to run BaseStation.

The AIS data is output over Ethernet in NMEA format when a TCP socket is opened to the NMEA port on the SBS-3. The default port number is 30007 but this can be changed using the Ethernet tab of the Non-volatile Memory Settings menu option in BaseStation.

### 4.1.8 Using a Frequency Converter

The SBS-3 or SDR Puck may be used with an external frequency converter between the antenna and the SBS-3, for example an up-converter allowing it to receive HF transmissions. In this case it is desirable for a frequency offset to be added to the tuner and SDR channel frequencies selected using the control panel.

This feature is enabled by checking the Frequency Converter box that appears under the pop-up tuning keyboard whenever it is next to the Tuner A and B panels. Checking this box allows the offset in MHz to be entered by clicking the Set button next to it. For example you should enter 125.0 if the external frequency converter up-shifts by 125 MHz.

If the frequency converter is to be used to tune below a certain frequency only, then you can also set this threshold in MHz. The threshold can be set to 0.0 if not used.

Whenever the frequency offset is applied, the tuner centre frequency and SDR channel frequency are displayed in yellow instead of green.

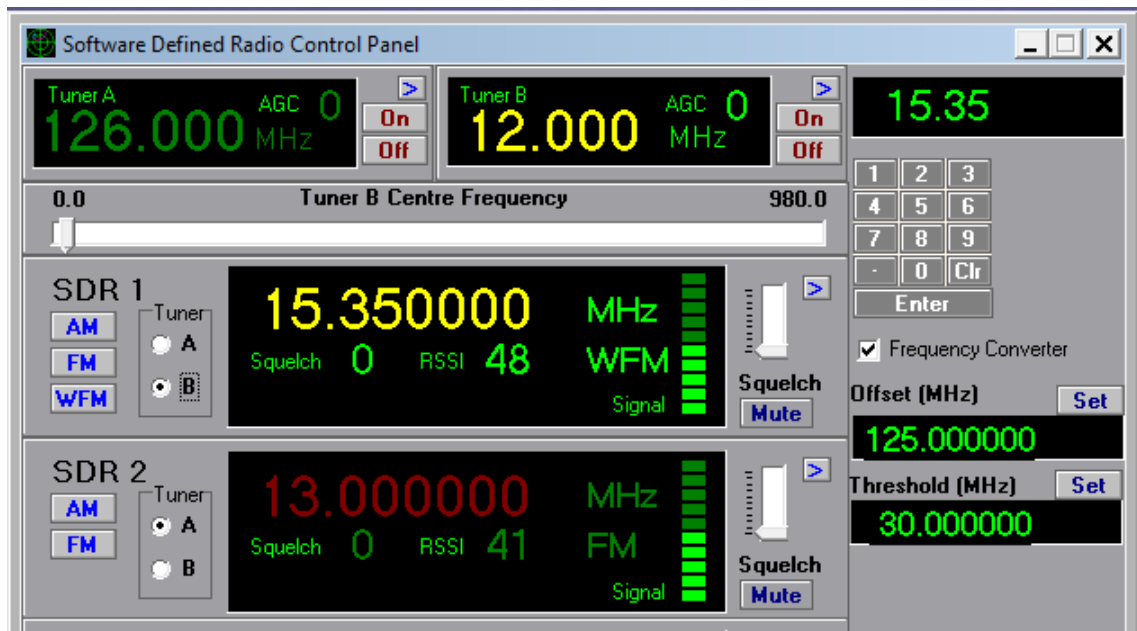


Figure 48: The SDR Control Panel used with a frequency converter

#### 4.1.9 Outputting I and Q Data from the SDR

The SBS-3 and SDR Puck are able to output in-phase and quadrature (I and Q) data from SDR channel 1, for use with a third party application such as SDR Sharp, which provides frequency-domain displays of the radio data from the SDR channel. The sample rate of the I and Q data is 192k samples per second, allowing a bandwidth of approximately 180 kHz to be displayed (after filtering), 90 kHz either side of the channel centre frequency.

- ✍ To use this feature on the SBS-3, you must connect to the SBS-3 using Ethernet rather than the USB port. This is because the required data rate is higher than that supported by the SBS-3's USB port.
- ✍ The USB port on the SDR Puck has a higher data rate and can be used to output I and Q data.
- ✍ While I and Q data is being output, SDR channel 1 cannot be used for other functions and Wideband FM demodulation cannot be performed. However channels 2 to 6 can be used for other functions as normal.

BaseStation can pass on the I and Q data to a TCP network port for the third party application to connect to, while simultaneously

allowing other features of BaseStation such as the aircraft displays to be used. To turn on the feature, use the Built-in SDR - I+Q Enable menu item.

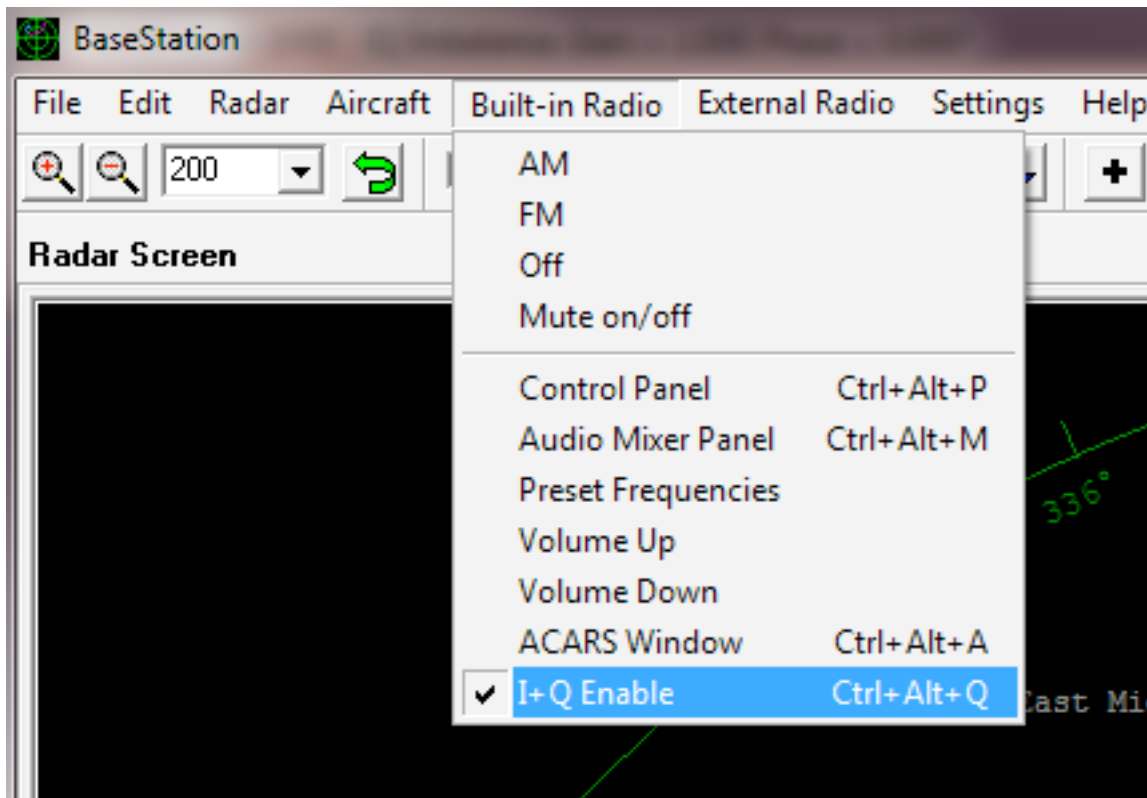


Figure 49: Enabling the I and Q Output

While in I and Q output mode, Tuner B (on the SBS-3) and SDR channels 2-6 can be controlled from BaseStation as normal, however Tuner A and SDR channel 1 are controlled by the SDR Sharp or other third party application. To reflect this, the controls for Tuner A and SDR channel 1 are removed from the control panel whenever this mode is enabled:



Figure 50: The SDR Control Panel with I and Q Enabled

When I and Q output mode is enabled, a panel appears on the status bar to show the connection status.

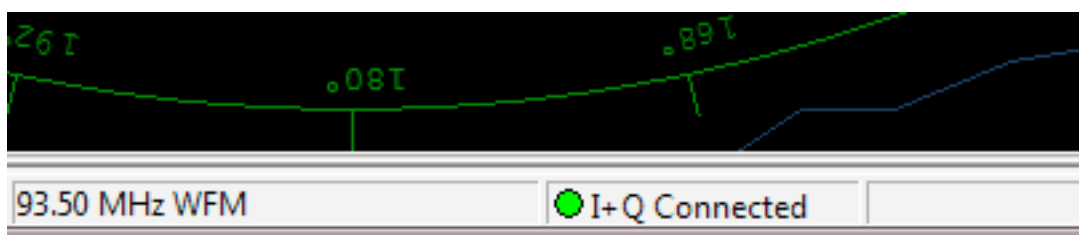


Figure 51: I and Q Output Status

The status bar shows a red symbol when BaseStation is not connected to an SBS-3 via ethernet, or to other Kinetic device that supports output of I and Q data.

It shows a blue symbol when BaseStation is connected to a suitable device but no application is connected to BaseStation's I and Q data output port (TCP port 30009).

Finally a green symbol is shown when an application such as SDR Sharp is connected to port 30009.

Please see also the section below on using SDR Sharp with the SBS-3 or SDR Puck.

#### **4.1.10 Using SDR Sharp with the SBS-3 or SDR Puck**

SDR Sharp is a third party SDR application that provides features such as frequency domain displays and SSB demodulation. For more information please visit:

[www.sdrsharp.com](http://www.sdrsharp.com)

SDR Sharp can be used in conjunction with BaseStation when I and Q output is enabled as described in the previous section. In this case other functionality of BaseStation can be used concurrently with SDR Sharp.

SDR Sharp can also be used with the SBS-3 or SDR Puck directly, without running BaseStation.

##### **4.1.10.1 Installing SDR Sharp**

1. Download and unzip a copy of SDR Sharp (current stable revision 1000) from the SDR Sharp website:

[www.sdrsharp.com/index.php/downloads](http://www.sdrsharp.com/index.php/downloads)

2. Copy the Kinetic interface file :

`SDRSharp.kinetic.dll`

and the FTDI USB driver file :

`ftd2xx.dll`

into the folder where you installed SDR Sharp

3. Edit the file:

`SDRSharp.exe.config`

using a text editor such as Notepad or Wordpad.

Locate the `<frontendPlugins>` section and add a line for the Kinetic interface:

```
<add key="Kinetic"
value="SDRSharp.kinetic.kineticIO,SDRSharp.kinetic" />
```

So that the section of the file looks something like:

```
<frontendPlugins>
<add key="SoftRock / Si570"
value="SDRSharp.SoftRock.SoftRockIO,SDRSharp.SoftRock" />
<add key="FUNcube Dongle Pro"
value="SDRSharp.FUNcube.FunCubeIO,SDRSharp.FUNcube" />
<add key="FUNcube Dongle Pro+"
value="SDRSharp.FUNcubeProPlus.FunCubeProPlusIO,SDRSharp.FUNcubeProPlus" /
>
<add key="Kinetic" value="SDRSharp.kinetic.kineticIO,SDRSharp.kinetic" />
</frontendPlugins>
```

4. Run SDRSharp.exe

5. In the drop down list at the top, select "kinetic" as the radio type:



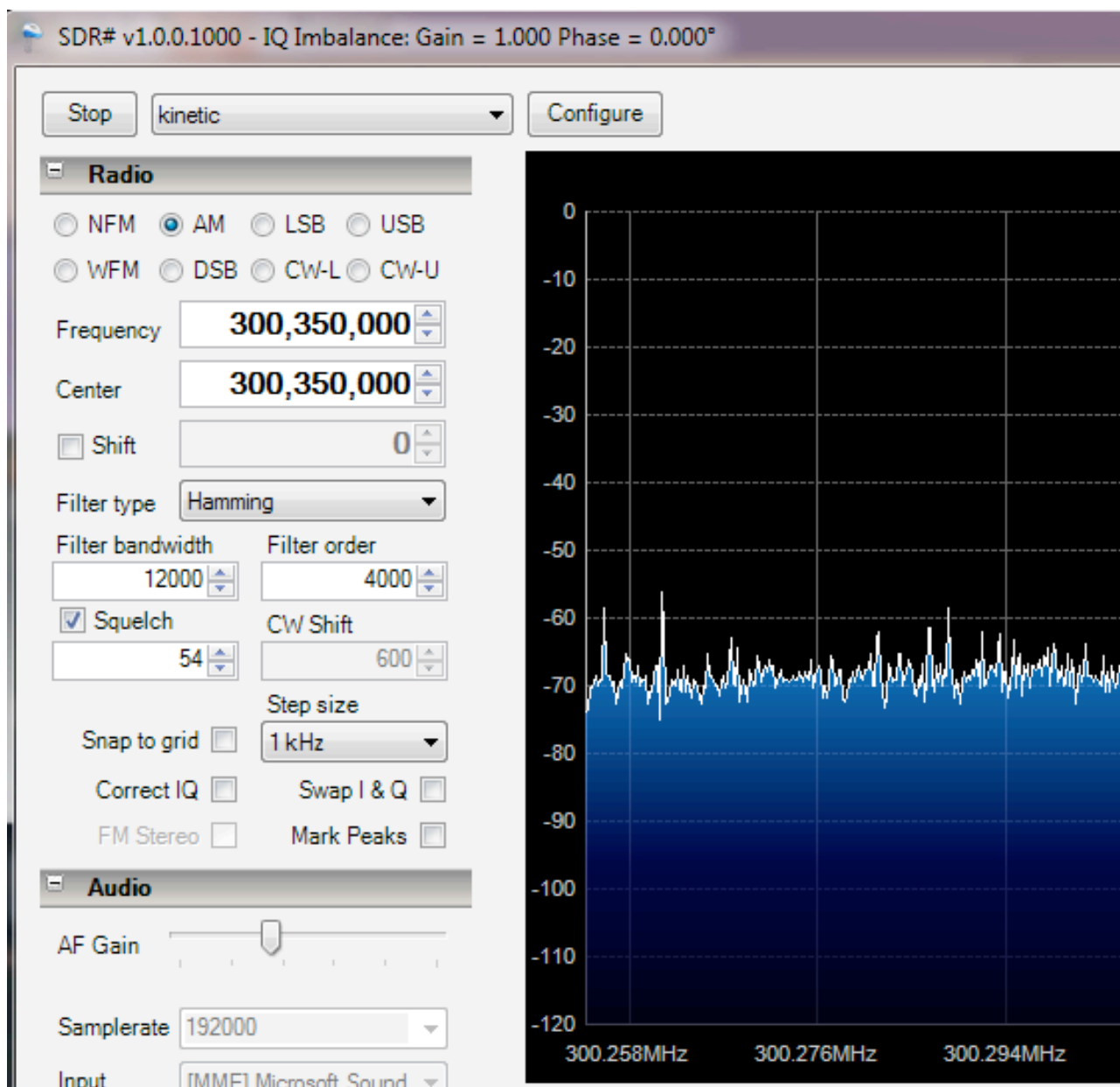


Figure 52: SDR Sharp Application Window

6. Press the Configure button to launch the configuration window. If an SBS-3 is being used then Ethernet should be selected. If using directly with the SBS-3 (without BaseStation) set the Host IP address to be the IP address of the SBS-3. Set the Host TCP port to be the main data output port of the SBS-3 (normally 10001). If connecting through BaseStation, set the Host IP address to be the IP address of the computer running BaseStation, and set the Host TCP port to be the I and Q data output port of BaseStation (normally 30009).
7. The Sample Bits setting should normally be set to 16. Setting it to 12 or 8 will reduce the data rate but results may be poor, especially with 8 bits.

8. The Frequency Correction box is an advanced setting that may be used to compensate for systematic tuning errors due to any small offset in the crystal oscillator frequency in the SBS-3. When this feature is not used it should be set to 0.0
9. The Frequency Offset box adds an optional fixed offset to the frequency sent to tune the SDR channel. This is useful when an external frequency converter is used between the antenna and the SDR. The frequency offset feature can be turned on or off using the check box.

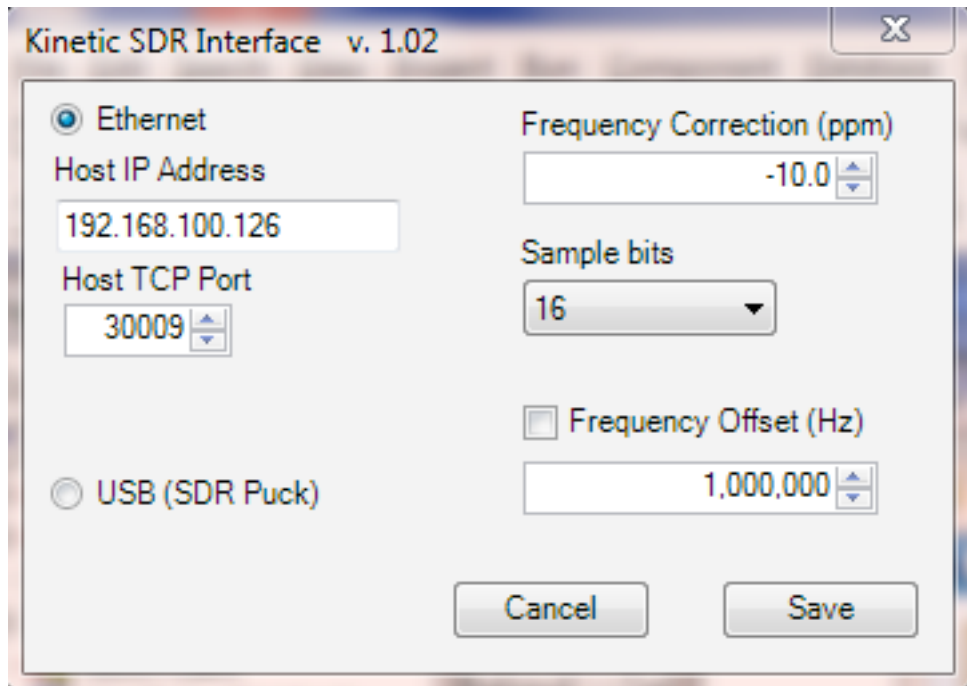


Figure 53: SDR Sharp Configuration Window for SBS-3 and Puck

10. Ensure that you click the Save button to save any settings you have changed.
11. Press the Start button to start receiving the data
12. Adjust the center frequency to the required frequency and select the demodulation type as required.
13. The "Correct IQ" check box should be left unchecked.

## 4.2 Using the Built-In Radio on the SBS-1eR

The SBS-1eR features a built-in Air-band / VHF FM receiver with integrated audio amplifier, as well as an external radio interface.

The external radio interface is described further in the next section.

The Built-in radio receiver covers the following frequencies :-

- Air-band AM :  
118.00 Mhz to 137.00 Mhz with 25Khz or 8.33Khz channel spacing.
- A UHF AM facility is available on SBS-1eR units with serial number 18000 or greater.
- VHF FM :  
76.00 Mhz to 108.00 Mhz with 50Khz channel spacing.

To listen to the built in radio, you can use the audio socket on the SBS-1eR, into which you can plug headphones or an audio cable to link to the sound card on your PC or other audio equipment.

Alternatively you listen to the digital audio stream using a suitable media player on your PC. See the section below on using digital audio streaming.

### 4.2.1 Customising The Built-in Radio User Interface

The built-in radio user interface includes extra toolbar buttons. Both the built-in radio and the external radio toolbar buttons can be independently made visible via the *Settings->Toolbars->Internal Radio* and *Settings->Toolbars->External Radio* menu options.

When the built-in radio toolbar is enabled should see the following buttons appear on your toolbar:



Figure 54: The Internal Radio Toolbar

If the external radio interface is also enabled then both sets of buttons will appear:



Figure 55: The Radio Toolbars With Both Radios Enabled

### 4.2.2 Using The Radio Interface

#### 4.2.2.1 Radio Menu






The top part of the radio menu allows you to turn the radio on and off and select the band.

The *Preset Frequencies* submenu allows you to select any frequency in BaseStation's radio frequency database. If you select a frequency

then the built-in radio receiver will be tuned into that frequency.  
 Note: BaseStation comes with frequencies for the UK. You can add more frequencies to the .rfq files in the *RadioFrequencies* subdirectory. Details of how to do this are available on the Kinetic forums.

The remaining menu items are equivalent to the items in the radio toolbar below.

#### 4.2.2.2 Radio Toolbar

-  Pressing this button makes the Radio Control Panel appear. Pressing it again makes it disappear.
-  Pressing this button brings up a menu which allows you to select any frequency in BaseStation's radio frequency database.
-  Pressing this button mutes the sound.
-  Pressing this button increases the volume.
-  Pressing this button decreases the volume.

#### 4.2.2.3 Radio Control Panel

The Radio Control Panel looks like this:

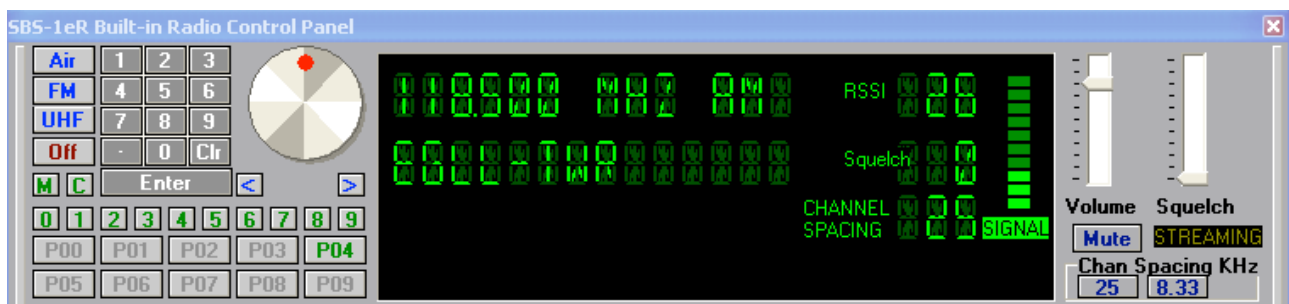


Figure 56: The SBS-1eR Radio Control Panel

The blue buttons on the left allow you to select which frequency mode to use.

The **Air** button selects Air-band AM operation.

The **FM** button selects VHF FM operation.

*The **UHF** button will be present only for SBS-1eR units manufactured with serial number 18000 or greater. It may be used to select the UHF Air-band, AM operation.*

The **Off** button allows you to turn the radio off. To turn the radio on again, simply select either the Air or FM button.

The **Channel Spacing** buttons select between 8.33Khz and 25Khz channel spacing in Air-band AM operation mode. In VHF FM mode, the channel spacing is fixed at 50Khz spacing.

The **Mute** button on the right-hand side of the panel allows you to mute the volume. When the radio is muted the green SIGNAL annunciator will turn into a red MUTE annunciator.

The **Volume** slider on the right-hand side of the panel allows you to adjust the volume.

The **Squelch** slider on the right-hand side of the panel allows you to adjust the squelch level in both AM and FM mode. When squelch is in operation, the signal level bar graph will turn from green to red. In Air-band AM mode, the squelch level is the level at which the built-in radio will automatically mute if the RSSI value falls below the setting.

In VHF FM mode, the squelch level is the level at which the built-in radio will automatically mute if the SNR value falls below the setting.

#### 4.2.2.4 Frequency Selection

The numeric keypad allows you to enter a frequency manually, clicking the **Ent** button when you have finished or **Clr** if you make a mistake. You can also type the frequency in using the numeric keypad of your PC, pressing the return/enter key when done.

The large knob (with red dot) allows you to adjust the frequency relative to its current setting. Simply click on the red dot and drag it either clockwise, or anti-clockwise. Alternatively you can step the frequency up or down using the blue "<" and ">" buttons just under the frequency knob.

The "LED" display shows the current frequency. If you selected the frequency by selecting a frequency from the BaseStation database (as opposed to manually typing it in) then it will also show the description of this frequency (in this case "EGLL-TWR").

#### 4.2.2.5 Frequency Presets

BaseStation can store up to 100 preset frequencies for the internal radio. These are accessed using the preset buttons at the bottom left of the control panel.

To listen to a preset frequency, simply click on the required preset button. Preset buttons with a frequency stored are shown in green, unused presets are shown greyed out. The presets are displayed in banks of 10, and you can switch between banks using the smaller green buttons labelled 0 to 9.

To store a frequency you are tuned to, click on the green M button and then the desired preset button: P00, P01 etc. Unused presets are shown in brown and used presets are shown greyed out after you click on M.

To clear a preset, click the green C button followed by the preset button.

#### 4.2.2.6 RDS Data

The bottom lines of the LED display are used to display RDS data from FM broadcasts, as in the example below:



Figure 57: The SBS-1eR Radio Control Panel - Broadcast FM

#### 4.2.2.7 Audio Streaming Indicator

BaseStation generates a digital audio stream from the built-in radio, for use by third-party applications. When such an application is connected, the STREAMING indicator on the control panel appears "lit" in bright yellow. When no streaming is taking place, it appears in dull yellow.

#### 4.2.2.8 Local Frequencies Right-Click Popup

You can right-click anywhere on the radar display and select "Local Frequencies-Built In Radio" from the resulting pop-up menu to get a list of the radio frequencies in use in that area. For example, clicking somewhere between Heathrow and Elstree would produce the following menu:

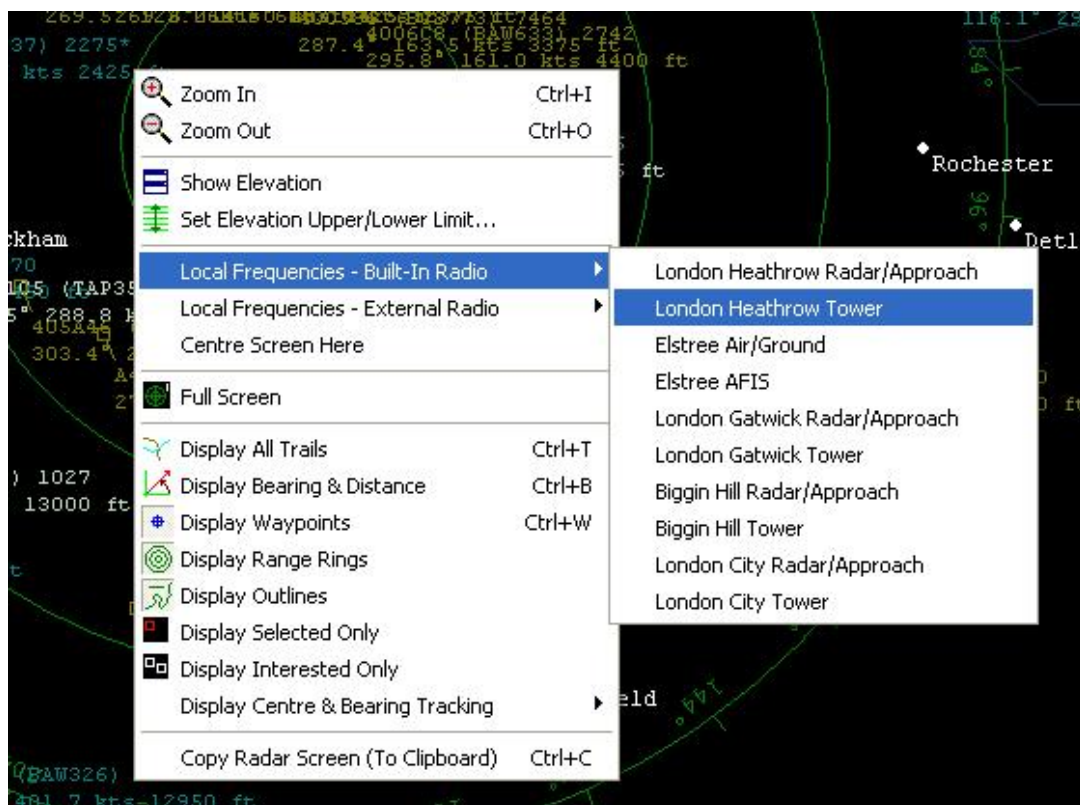


Figure 58: The Local Frequencies submenu

The frequencies are sorted in order of the waypoints that they are associated with.

Simply click on the desired frequency from the list to tune the radio to that frequency.

The built-in radio and external radio can be tuned to separate frequencies for maximum flexibility.

## 4.3 Using Digital Audio Streaming

### *SBS-3 SBS-1eR, SDR Puck*

BaseStation supports audio streaming from the internal radio using the standard network protocols RTSP and RTP/UDP. This stream can be played using a suitable media player application, including VLC and Apple QuickTime. A free version of VLC can be downloaded from [www.videolan.org/vlc](http://www.videolan.org/vlc)

🔍 The media player used must support 16-bit linear PCM delivered over RTP/UDP.

🔍 There will be a delay in the audio due to the streaming.

To play the stream using RTSP on the local machine, open the following URL in the media player (On VLC this can be done from the *File > Open Network* menu):

rtsp://127.0.0.1

👉 If the media player is on a different machine from BaseStation, then substitute the network address of the machine running BaseStation instead of 127.0.0.1

### 4.3.1 Advanced Settings for Audio Streaming

There is also an audio settings tab in the Hardware Settings menu for “advanced” users:

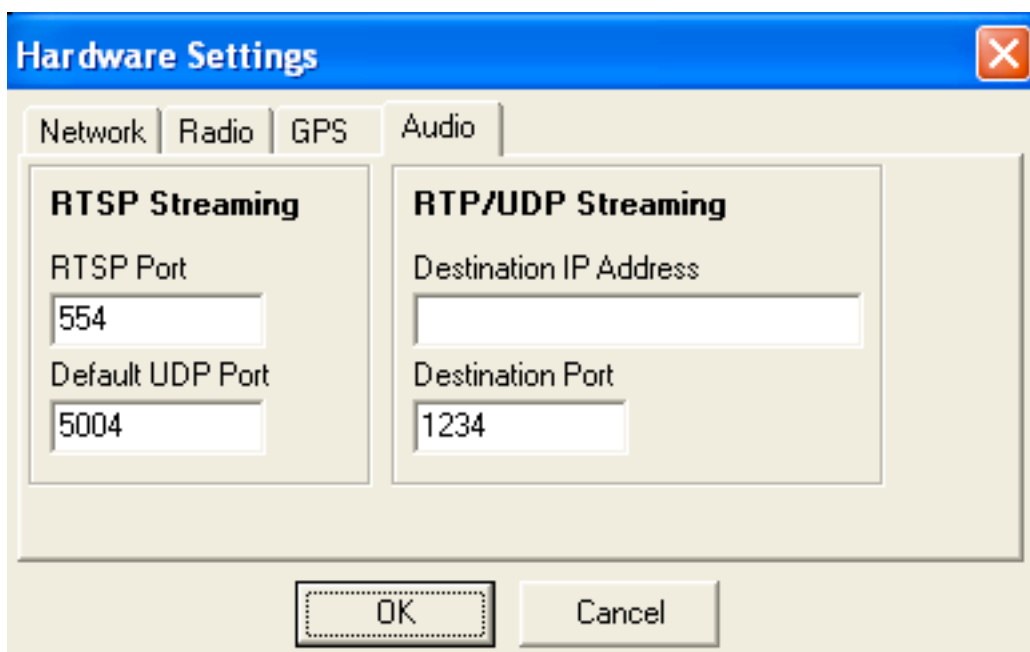


Figure 59: The Hardware Settings menu - Audio Tab

Under **RTSP Streaming**, the *RTSP Port* setting allows BaseStation’s RTSP server port to be changed from the default (in case you are running another streaming service from your PC). The Default UDP



Port setting can be used to change the UDP port that the streaming will be offered on by default to the media player. Note that the media player may negotiate a different port regardless of this setting.

**RTP/UDP Streaming.** BaseStation also allows a targeted RTP over UDP stream to be set up without using RTSP if required, by entering a destination network address and port. Setting a non-blank address will cause the UDP stream to be sent (and the Streaming indicator on the control panel to illuminate). The receiving player will need to be configured to expect 16-bit, 16000Hz single-channel linear PCM. On VLC or QuickTime this can be done for example by opening an .sdp file containing the following text (where UDP port number is 1234) :

v=0

o=BaseStation 12345 12345 IN IP4 127.0.0.1

s=BaseStationAudio

t=0 0

m=audio 1234 RTP/AVP 98

a=rcvonly

a=rtpmap:98 L16/16000/1

## 4.4 External Radio Interface

### 4.4.1 Enabling The External Radio Interface

The radio interface supports multiple models of radio through the use of a separate BaseStation Interface Unit (.biu) file for each model or range.

To configure the interface, launch the *Hardware Settings* dialog box by selecting the *Settings > Hardware Settings* menu item, and then select the correct .biu file for your model of radio. If you are unsure which .biu file is appropriate, then contact your dealer for advice.

You should also be sure to select the appropriate method of connection (either your PC's serial port or the SBS unit's serial port).

Once you have done this and clicked on OK, the Radio menu will appear in the top-level menu bar.

### 4.4.2 Customising The External Radio User Interface


The radio user interface includes extra toolbar buttons that are not initially activated. To activate them, click on the *Settings > Toolbars > Radio* menu option.

You should then see the following buttons appear on your toolbar:



Figure 60: The External Radio Toolbar

### 4.4.3 Using The External Radio Interface

 You will not necessarily have access to all functions in the radio interface, as only those functions that are supported by your model of radio are implemented. For example, if your radio does not support the setting of volume from a PC, then all volume controls will be greyed out.


#### 4.4.3.1 Radio Menu


The first few items on the radio menu allow you to turn the radio on and off and reset it.

The *Preset Frequencies* submenu allows you to select any frequency in BaseStation's radio frequency database. If you select a frequency then your scanner will be tuned into that frequency. Note that BaseStation comes with frequencies for the UK. You can add more frequencies to the .rfq files in the RadioFrequencies subdirectory. Details of how to do this are available on the Kinetic forums.


The remaining menu items are equivalent to the items in the radio toolbar below.


#### 4.4.3.2 Radio Toolbar

 Pressing this button makes the Radio Control Panel appear. Pressing it again makes it disappear.

 Pressing this button brings up a menu which allows you to select any frequency in the BaseStation radio frequency database.

 Pressing this button mutes the sound.

 Pressing this button increases the volume.

 Pressing this button decreases the volume.

#### 4.4.3.3 Radio Control Panel

The Radio Control Panel looks like this:

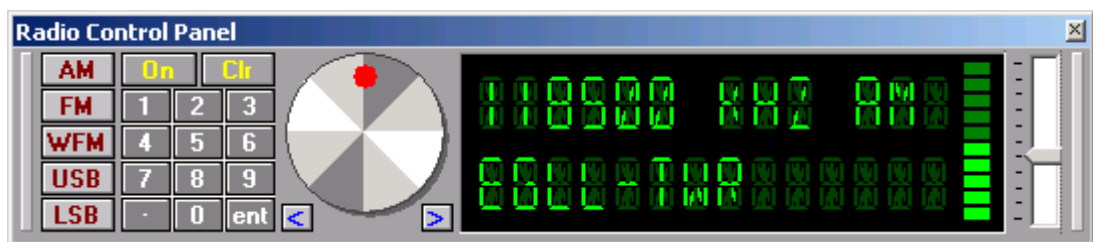



Figure 61: The External Radio Control Panel

The grey buttons on the left allow you to select which frequency mode to use.

The **On** button allows you to turn the radio on.

The numeric keypad allows you to enter a frequency manually, clicking the **ent** button when you have finished or **Clr** if you make a mistake. You can also type the frequency in using the numeric keypad of your PC, pressing the enter key when done.

 Although BaseStation remembers the frequency as kHz (as in the above example), you can enter them as MHz (i.e. you could type in "118.5" in order to select 118500 khz – BaseStation will simply convert it).

The large knob (with red dot) allows you to adjust the frequency relative to its current setting. Simply click on the red dot and drag it either clockwise, or anti-clockwise.

The blue left and right buttons allow you to make minor adjustments to the frequency.

Finally, the slide on the right-hand side of the panel allows you to adjust the volume.

The "LED" display shows the current frequency and volume. If you selected the frequency by selecting a frequency from the BaseStation database (as opposed to manually typing it in) then it will also show the description of this frequency, in this case "EGLL-TWR".

#### 4.4.3.4 Local Frequencies Right-Click Popup

You can click anywhere on the map and select "*Local Frequencies-External Radio*" from the resulting pop-up menu to get a list of the radio frequencies in use in that area. For example, clicking somewhere between Heathrow and Elstree would produce the following menu:

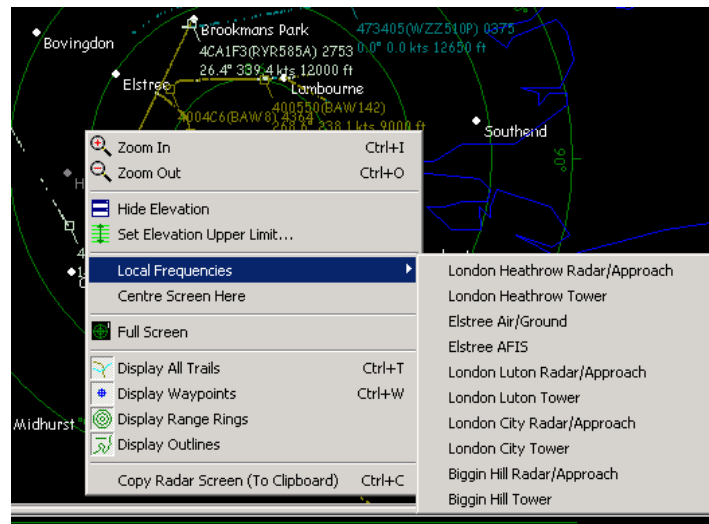


Figure 62: The Local Frequencies submenu

The frequencies are sorted in order of the waypoints that they are associated with. Simply click on the desired frequency to have your radio tuned to that frequency.

#### 4.4.4 Connecting the SBS-3 Serial Port to an External Radio

BaseStation supports control of a suitable external radio using the SBS-3's RS232 interface. Pins 4 and 6 of the RJ11 interface connector on the SBS-3 will need to be connected to the radio's RS232 control input.

The pin-out of the RJ11 interface connector on the rear of the SBS-3 is as follows:

*Pin 1 is the rightmost pin as viewed from the rear of the SBS-3*

Pin 1 : 5VDC. (Pull up resistors only. **Not to be used for powering any external equipment.** )

Pin 2 : I2C Clock (Used by Kinetic for external module options)

Pin 3 : I2C Data (Used by Kinetic for external module options)

Pin 4 : RS232 Tx (Used to control external Radio receivers)

Pin 5 : RS232 Rx (Used to obtain GPS co-ordinates for BaseStation when selected)

Pin 6 : RS232 & I2C Ground

## 5 Configuring **SBS-3** Ethernet Settings

The Ethernet settings for the SBS-3 (including its IP address and port numbers) are stored in its internal non-volatile memory. These settings can be inspected and changed using BaseStation.

With BaseStation connected to the SBS-3 either by USB or by Ethernet, select the “Non-Volatile Memory Settings” option from the “Settings” menu. The following screen should be displayed:

The screenshot shows the 'SBS-3 Non Volatile Memory Configuration' window with the 'Ethernet Setup' tab selected. The window has three tabs: 'Ethernet Setup', 'Stand-Alone Data', and 'Built-in Radio'. The 'Ethernet Setup' tab contains the following fields and options:

- IP Address:** Four input boxes containing 192, 168, 100, and 98.
- Subnet Mask:** Four input boxes containing 255, 255, 255, and 0.
- Gateway:** Four input boxes containing 192, 168, 100, and 1.
- Speed:** Two radio buttons: '10 Mb' (unselected) and '100 Mb' (selected).
- Full Duplex:** A checked checkbox.
- Auto Negotiate:** A checked checkbox.
- Main Connection:** Two radio buttons: 'SBS-3 as Server' (selected) and 'SBS-3 as Client' (unselected). The 'SBS-3 as Client' option has a 'Retry every' field set to 0 seconds.
- Port:** An input box containing 10001.
- Remote Server IP Address:** Four input boxes, all containing 0.
- Remote Port:** An input box containing 0.
- NMEA Connection:** Two radio buttons: 'SBS-3 as Server' (selected) and 'SBS-3 as Client' (unselected). The 'SBS-3 as Client' option has a 'Retry every' field set to 0 seconds.
- Port:** An input box containing 30007.
- Remote Server IP Address:** Four input boxes, all containing 0.
- Remote Port:** An input box containing 0.

At the bottom of the window are 'OK' and 'Cancel' buttons.

Figure 63: Non Volatile Memory Settings - Ethernet Tab

The **IP address** is set to a default value of 192.168.1.170 when the SBS-3 unit is shipped. You may need to change this if your PC's LAN uses an address range other than 192.168.1.xxx.

🔗 If you change the IP address on the SBS-3 box, you should also change the BaseStation settings for Ethernet under “Settings” – “Hardware” – “Network”, so that BaseStation can reconnect to the SBS-3.

The **Subnet Mask** setting depends on the address size of the local network. Typically, for 192.168.x.x networks, it is normally set to 255.255.255.0.

The **Gateway** address is normally set to the IP address of your local router.

The **Speed** setting sets the speed of the Ethernet interface on the SBS-3. It can be set either to 10 M bit/sec or to 100 M bit/sec. This setting is ignored if Auto Negotiation is turned on.

The **Full Duplex** checkbox sets Full Duplex mode for the Ethernet interface (the default). This setting is ignored if Auto Negotiation is turned on.

The **Auto Negotiate** checkbox turns on negotiation of connection speed etc. between the SBS-3 Ethernet port and the device it is connected to (e.g. PC, router or Ethernet switch). Auto negotiation is on by default. It can be turned off where there are specific problems with this. In this case the Speed and Duplex mode should be selected manually.

The **Main Connection** panel is used to configure the way that BaseStation or other application communicates with the SBS-3 over the network. Normally the SBS-3 is configured as a server, and the **Port** value sets the TCP port number used by BaseStation or other application to connect to and receive data from the SBS-3. The default port number used by the SBS-3 and BaseStation is 10001. You may need to change the port number to another value to be able to work with a particular application.

✍ If you change the Main Port setting on the SBS-3 box, you should also change the port number in the BaseStation settings under "Settings" – Hardware – Network, so that BaseStation can reconnect to the SBS-3.

The **NMEA Connection** panel is used for specifying a separate port for output of AIS marine data in NMEA format.

The SBS-3 can also connect as a TCP/IP client to a third party application, instead of acting as a TCP/IP server. Firmware version L\_0202\_0000\_0118\_SBS3 or later is required for this. In this mode you need to enter the **Remote Server IP Address** and **Remote Port** for the SBS-3 to connect to. The SBS-3 will repeatedly try to connect, waiting for the specified re-try interval between attempts. The connection mode can be configured separately for the main data connection and the NMEA port. If you set the client connection mode for the main port then BaseStation will no longer be able to connect to the SBS-3 using Ethernet. You will have to connect via USB in order to change the settings back to normal operation (server mode).

## 6 Stand-Alone Operation of the **SBS-3**

### 6.1 Stand-Alone Data Feed

The SBS-3 can be used without BaseStation to feed data to a third party application. The application can connect via Ethernet to the main data port of the SBS-3 instead of BaseStation. The data on this port contains raw ADS-B and other Mode-S messages, and optionally Mode A/C data. Applications can also control the SDR and other features of the SBS-3 through this port using the Kinetic API.

A document describing the data format and API can be obtained from the Kinetic Avionics website: [www.kinetic.co.uk](http://www.kinetic.co.uk)

Note: this feature is not currently available on the SBS-1 family.

BaseStation can be used to configure the SBS-3 for stand-alone use. This is done using the "*Non-Volatile Memory Settings*" option from the "*Settings*" menu .

If required, the main port number can be changed from the default of 10001, using the *Ethernet Settings* tab.

The Stand-Alone Data tab is used to enable certain features of the data to be output. These settings will be retained when the box is powered up without BaseStation.

☞ These settings apply only to subsequent operation without BaseStation. When you run BaseStation, these settings are ignored. To control the settings when used with BaseStation, use the Settings-Data Settings menu.

☞ When the SBS-3 is connected to BaseStation, the main data port is in use by BaseStation, and does not support a second connection. Third party applications can however still connect via Ethernet to port 30006 on BaseStation to obtain the raw data. Other applications may connect to port 30003 on BaseStation to obtain decoded positions and other data for aircraft. This format of this data can also be obtained via the Kinetic Avionics website.

In stand-alone mode, third party applications can also receive AIS marine data by connecting via Ethernet to the NMEA data port of the SBS-3. This is on TCP port 30007 by default, although this port number can also be changed under the *Ethernet Settings* tab of the "*Settings - Non-Volatile Memory Settings*" menu.

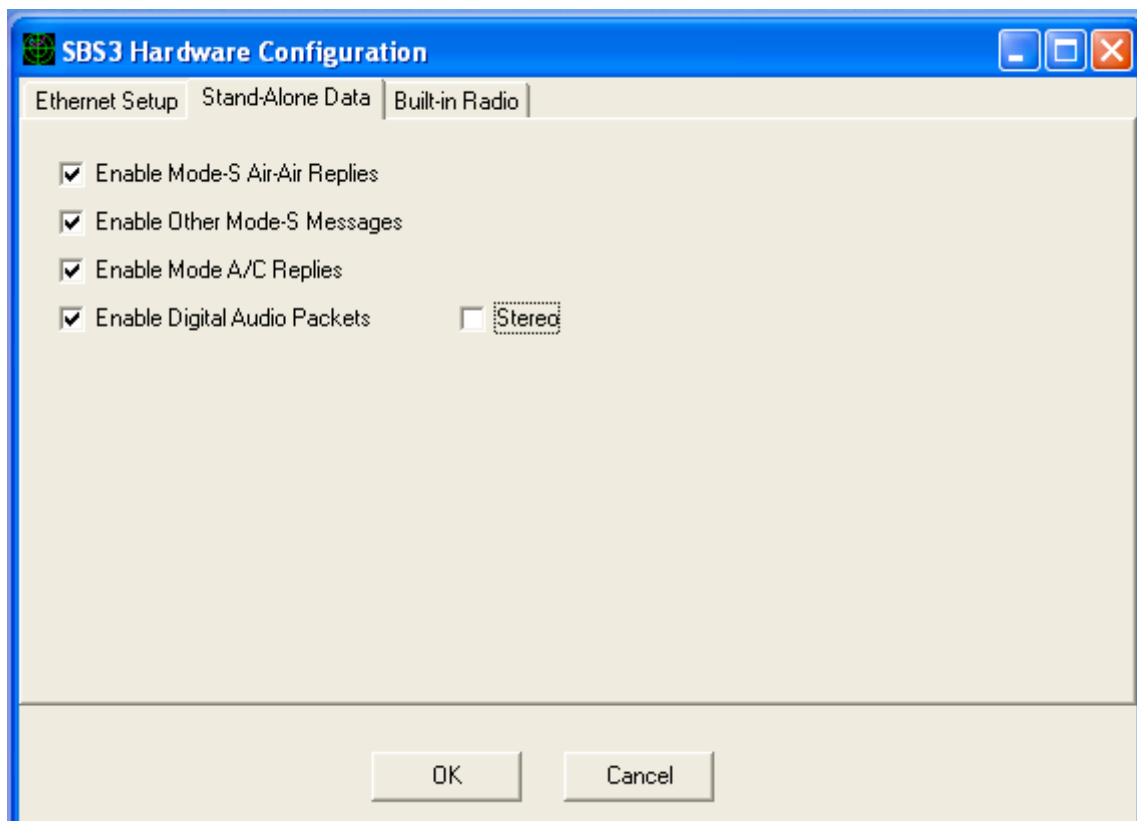


Figure 64: Non Volatile Memory Settings - Stand Alone Data Tab

**Enable Mode-S air-air replies:**

Enables output of Mode-S DF 0 and DF 16 messages.

**Enable other Mode S messages:**

Enables other Mode S messages including DF 11 messages with a nonzero PI field.

**Enable Mode A/C replies:**

Enables output of Mode A and C data.

**Enable Digital Audio Packets:**

Outputs RAW digital audio data (16 bit, 16k samples per second, mono or stereo).



## 6.2 Stand-Alone Operation of the SDRs

On the Built-in Radio tab on the SBS-3 Non Volatile Memory settings screen, a button allows all of the SDR settings (including the selected frequencies and mixer settings) to be written to the SBS-3's non-volatile memory so that they will be used on power up, without BaseStation.

A second button allows the settings in the Non Volatile memory to be returned to their default state (i.e. radios will be left powered down when the SBS-3 is powered up stand-alone).

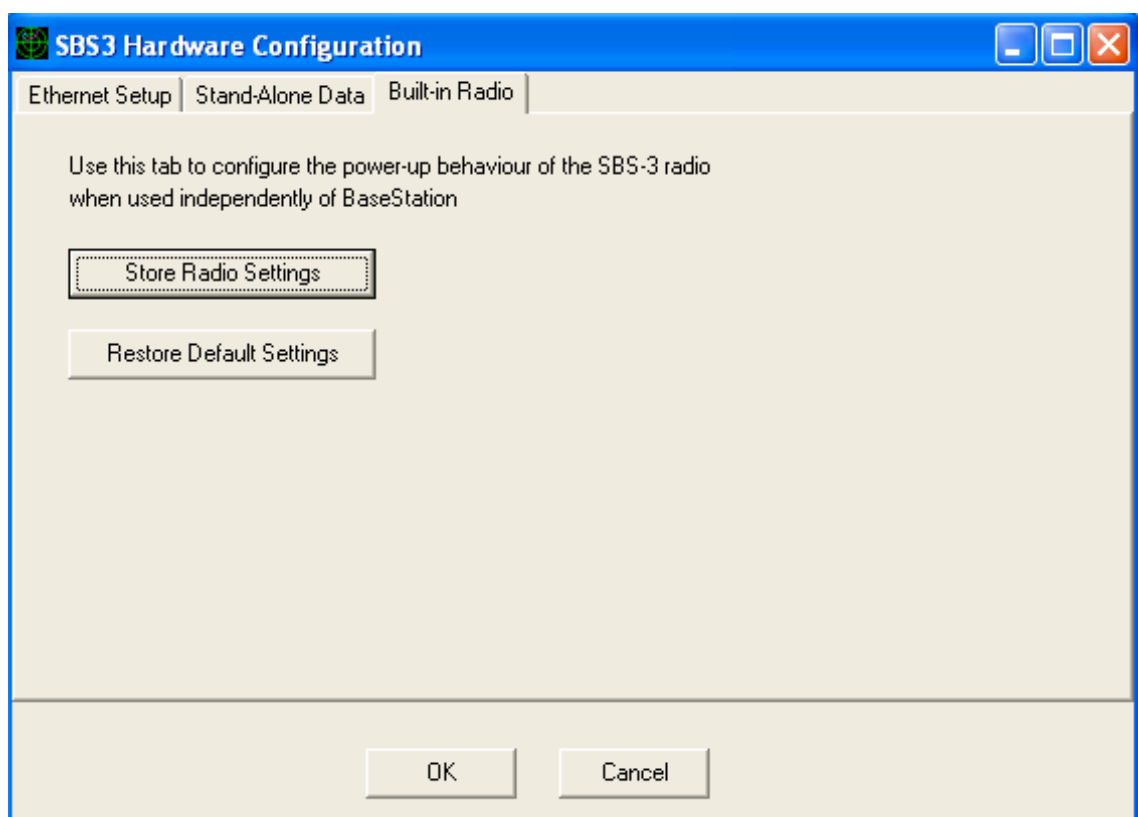


Figure 65: Non Volatile Memory Settings - Built-in Radio Tab

## 7 BaseStation Reporter

### 7.1 Introduction

The BaseStation Reporter is the companion program to BaseStation. It allows you to browse the historical data that BaseStation saves into the database.

### 7.2 Using BaseStation Reporter

#### 7.2.1 Main Screen

##### 7.2.1.1 Aircraft Tab

The aircraft tab shows the aircraft in the database in the top pane, with the flights made by the selected aircraft in the bottom pane.

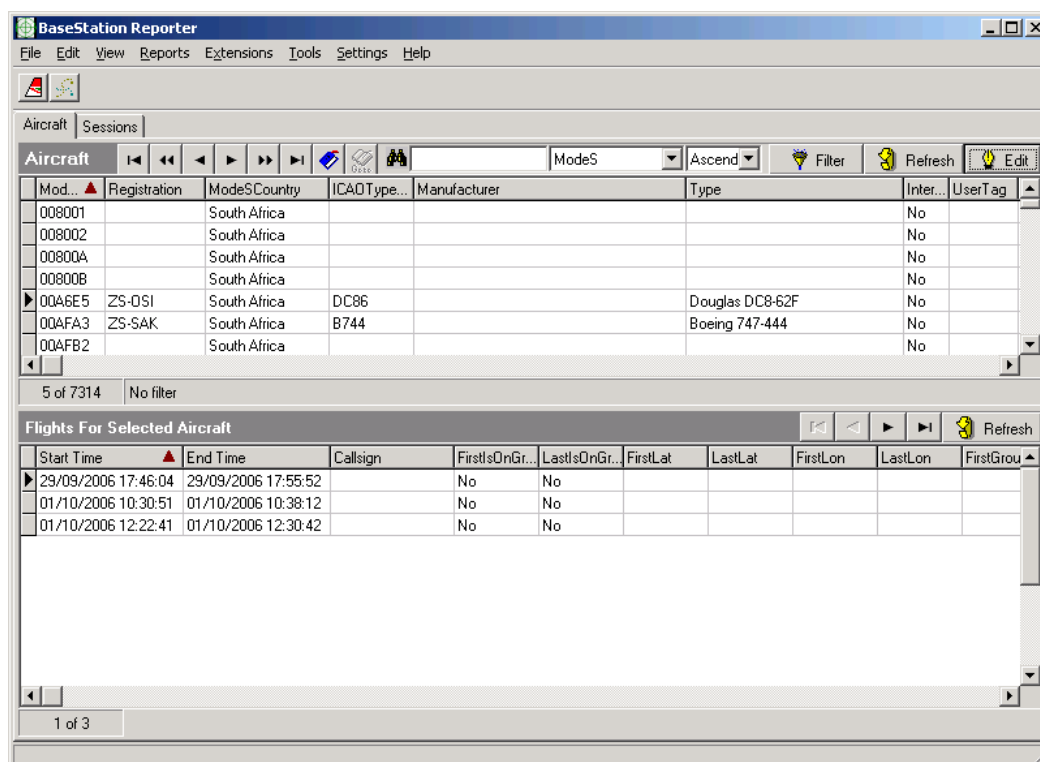


Figure 66: Reporter's main screen, open on the Aircraft tab

The grid can easily be customised. To sort on a column, click on it. To change the sort order to descending, click on it again.

- You can also set the sort order and direction using the pop-down lists on the aircraft control strip (the ones just to the left of the Filter button).

To change the order of the columns, simply click on a column heading, and drag it to where you want it to be. The Refresh buttons cause the application to re-read its data from the database.

- You would only need to do that if you want to see aircraft and flights that BaseStation has since written into the database.

To search for a particular record in the aircraft list, first set the sort order of the aircraft grid to the field you want to search on, and then start typing the phrase you are looking for into the edit box next to the binoculars icon. After you type each letter, the grid will jump to the first aircraft that matches that phrase. (i.e. If you set to sort on manufacturer and then type in "Bo" it might jump to the first aircraft with a value of "Boeing"). If you type a letter such that the phrase now doesn't match an aircraft, the edit box will turn red.

The Filter button allows you to set a filter so that only aircraft matching certain criteria are shown in the aircraft. Upon clicking on it, the following dialog box will appear:

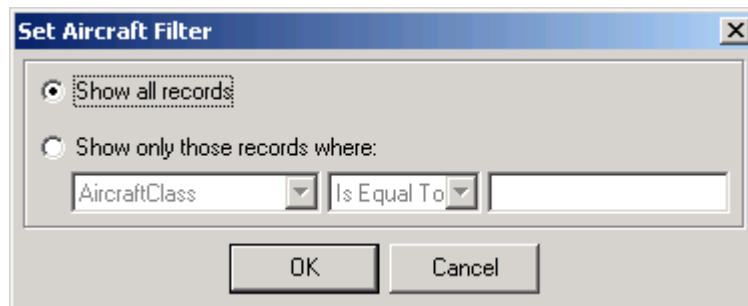


Figure 67: The Set Aircraft Filter dialog box

To set a filter, select the "Show only those records where" radio button, and then select the desired filter in the lower boxes.

The filter will be displayed in the status strip under the grid, and will stay active until you cancel it using the Set Aircraft Filter dialog (by selecting back to "Show all records").

The Edit button allows you to edit the details of the selected aircraft. Upon clicking on it, the aircraft details will appear in a dialog box:

Figure 68: The Edit Aircraft dialog

To update the values for the aircraft, simply enter in the details and then click on OK. To help you keep track of which values you have edited, edit boxes turn red once changed.

### 7.2.1.2 Sessions Tab

The sessions tab shows the sessions in the database in the top pane, with the flights made during the selected session in the bottom pane.

☞ A session is basically the period from when you ran BaseStation to when you shut it down. Each time you do this it counts as one session.

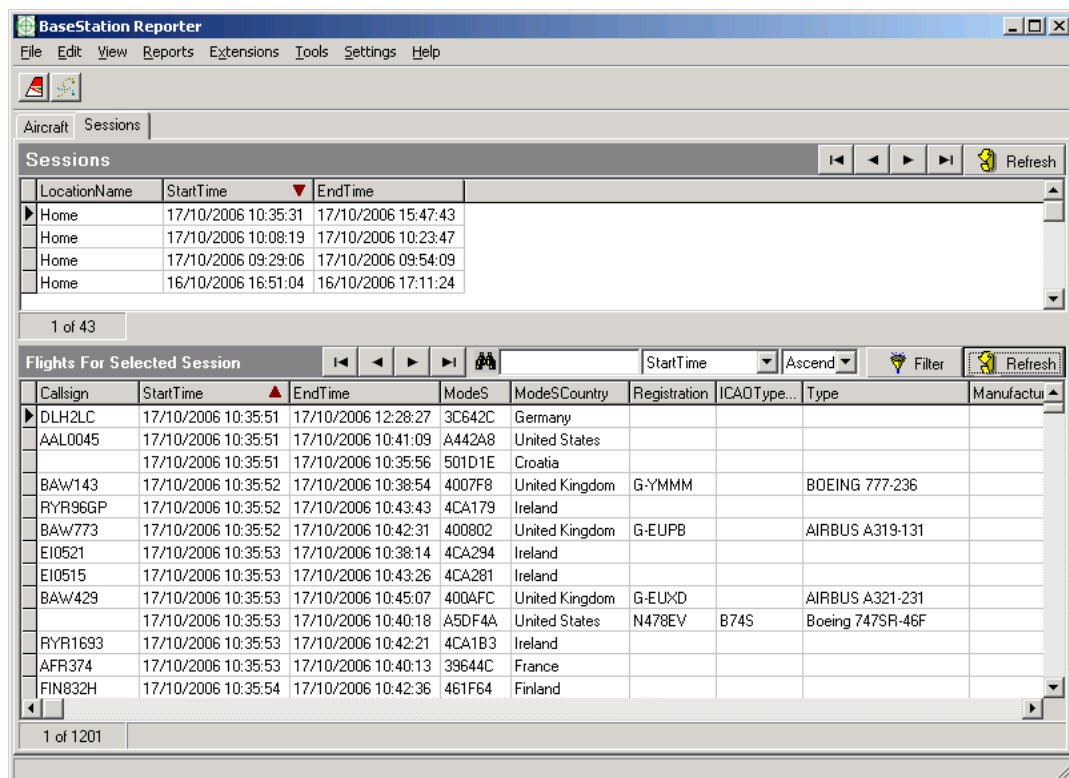


Figure 69: Reporter's main screen, open on the Sessions tab

The controls on the sessions tab work in exactly the same way as on the aircraft tab. In particular, you can search and filter the Flights grid in the same way as you can the Aircraft tab's Aircraft grid.

## 7.2.2 Menus

### 7.2.2.1 File

**Export Database:** The options in this submenu allow you to export specific tables within the database to .csv files, which can be imported by spreadsheet or database applications.

**Export Grid:** The options in the submenu allow you to export the four grids displayed on the main window to .csv files.

**Backup Database:** This menu option produces a *BaseStation backup file* (.bbk) that contains all of the data in the database.

**Restore Database:** This menu option allows the user to restore a previously backed up set of data (.bbk file).

- 💣 If you restore a .bbk file, all of the data that is currently in your database will be erased.

#### 7.2.2.2 Edit

**Copy:** The options in the submenu allow you to copy the four grids displayed on the main window to the clipboard.

#### 7.2.2.3 Reports

**Aircraft Report:** This menu option produces a report (that can be printed, previewed, or saved to .csv) of all the aircraft in the database.

**Flights Report:** This menu option produces a report (that can be printed, previewed, or saved to .csv) of all the flights that were tracked for a certain time period.

- ☞ The initial from and to times that appear in the Flights Report dialog are taken from the session that is currently selected in the Sessions tab. (i.e. The default is to produce a report showing all the flights that were made during the current session).

#### 7.2.2.4 Tools

**Pack Database:** This menu option removes unused space from the database file to reduce its size.

- 💣 This option must not be invoked while BaseStation (or any other application that uses the BaseStation database) is running.

#### 7.2.2.5 Settings

**Show Status Bar:** This menu option toggles the status bar on and off.

**Allow Direct Aircraft Editing:** Setting this menu option (i.e. clicking on it so that a tick appears) allows you to edit the values in the aircraft grid simply by clicking on a cell).

- 💣 This setting should be used with caution since, when enabled, it is easy to inadvertently alter data without realising.

**Set Grid Request Limits:** This menu option brings up a dialog that allows you to select how many records can be shown in each of the four grids. If your database grows beyond this amount, then the status area under each grid will show you which portion of the table you are currently looking at, and will have controls allowing you to move through the data.

## 8 BaseStation Logger

BaseStation Logger is a simple program that, when run, connects to BaseStation and writes out log files containing all the messages that are being received as well as other bits of information. These files, which are in CSV format, can then be analysed by spreadsheets such as Excel, or by custom applications.

A detailed description of the format of these log files is beyond the scope of this manual. Those requiring more details should visit the Development forum on the SBS web-forums.

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- 4.1 The Licensee may permit any employee of the Licensee to exercise the rights granted by the Licensor to the Licensee under Clause 3.2(c) and (d), subject always to the restrictions set out in Clause 3.  
The Licensee may permit any person living permanently at the property where the Computer is habitually situated to exercise the rights granted by the Licensor to the Licensee under Clause 3.2(c) and (d), subject always to the restrictions set out in Clause 3.
- 4.2 The Licensee must ensure that any person using the Software and/or Documentation in accordance with Clause 4.1 is made aware of, and agrees to, the terms of this EULA.

#### **5. Upgrades**

- 5.1 The Licensee may apply to the Software each Upgrade released by the Licensor and provided / made available by the Licensor to the Licensee from time to time.
- 5.2 The Licensor will have no obligation to provide support for the Software or repair or replace the Software under Clause 7.2(d) in relation to any version of the Software that does not incorporate the most recent Upgrade to the Software.

## **6. Support**

- 6.1 The Licensor may optionally choose to provide to the Licensee telephone support between the hours of 10.00 and 16:00 (London time) for the purpose of resolving issues with the Software raised by the Licensee acting reasonably.
- 6.2 The Licensee acknowledges that:
- (a) the Licensor's obligation under Clause 6.1 is subject to such limits (as to time spent in relation to an issue and in relation to the Licensee in aggregate) as the Licensor may determine from time to time;
  - (b) the Licensor's sole obligation under Clause 6.1 is to make reasonable endeavours to resolve issues raised by the Licensee;
  - (c) the Licensor does not warrant or represent that issues raised will be solved by means of the support services; and
  - (d) the Licensor will not provide any on-site support under this EULA.
- 6.3 The Licensor may subcontract any of its obligations under this Clause 6 to any third party.

## **7. Limited warranties**

- 7.1 The Licensee warrants to the Licensor that it has the legal right and authority to enter into and perform its obligations under this EULA.
- 7.2 The Licensor warrants to the Licensee:
- (a) that it has the legal right and authority to enter into and perform its obligations under this EULA;
  - (b) that the use of the Software by the Licensee in accordance with the terms of this EULA will not infringe the UK Intellectual Property Rights of any third party;
- 7.3 The Licensee acknowledges that:
- (a) the Software may not be error-free and that errors in the software will not constitute a breach of this EULA;
  - (b) the Software has not been developed to meet specific requirements of the Licensee, and accordingly the Licensee will be responsible for ensuring that the Software is suitable to meet the Licensee's requirements.
- 7.4 All of the parties' liabilities and obligations in respect of the subject matter of this EULA are expressly set out herein. To the maximum extent permitted by applicable law, no other terms concerning the subject matter of this EULA will be implied into this EULA or any related contract.

## **8. Limitations and exclusions of liability**

- 8.1 Nothing in the EULA will:
- (a) limit or exclude the liability of a party for death or personal injury resulting from negligence;
  - (b) limit or exclude the liability of a party for fraud or fraudulent misrepresentation by that party;

- (c) limit any liability of a party in any way that is not permitted under applicable law; or
- (d) exclude any liability of a party that may not be excluded under applicable law,

and, if you are a consumer, any statutory rights which you have, which cannot be excluded or limited, will not be affected by the EULA.

8.2 The limitations and exclusions of liability set out in this Clause 8 and elsewhere in the EULA:

- (a) are subject to Clause 8.1; and
- (b) govern all liabilities arising under the EULA or in relation to the subject matter of the EULA, including liabilities arising in contract, in tort (including negligence) and for breach of statutory duty.

8.3 The Licensor will not be liable to the Licensee for any losses arising out of a Force Majeure Event.

8.4 The Licensor will not be liable to the Licensee in respect of any business losses, such as loss of or damage to profits, income, revenue, use, production, anticipated savings, business, contracts, commercial opportunities or goodwill.

8.5 The Licensor will not be liable to the Licensee in respect of any loss or corruption of any data, database or software.

8.6 The Licensor will not be liable to the Licensee in respect of any special, indirect or consequential loss or damage.

## 9. Termination

This EULA will terminate immediately and automatically if:

- (a) the Licensee or any employee of the Licensee or person authorised by the Licensee to use the Software and/or Documentation breaches any provision of this EULA;
- (b) the Licensee: (i) is dissolved; (ii) ceases to conduct all (or substantially all) of its business; (iii) is or becomes unable to pay its debts as they fall due; (iv) is or becomes insolvent or is declared insolvent; or (v) convenes a meeting or makes or proposes to make any arrangement or composition with its creditors;
- (c) an administrator, administrative receiver, liquidator, receiver, trustee, manager or similar is appointed over any of the assets of the Licensee;
- (d) an order is made for the winding up of the Licensee, or the Licensee passes a resolution for its winding up; or
- (e) (where the Licensee is an individual) the Licensee dies, or as a result of illness or incapacity becomes incapable of managing his or her own affairs, or is the subject of a bankruptcy petition or order.

## 10. Effects of termination

10.1 Upon termination all the provisions of this EULA will cease to have effect, save that the following provisions will survive and continue to have effect (in accordance with their terms or otherwise indefinitely): Clauses 1, 8 and 11.

10.2 Termination of this EULA will not affect either party's accrued rights and liabilities.

## **11. General**

- 11.1 No breach of any provision of this EULA will be waived except with the express written consent of the party not in breach.
- 11.2 If a Clause of this EULA is determined by any court or other competent authority to be unlawful and/or unenforceable, the other Clauses of this EULA will continue in effect. If any unlawful and/or unenforceable Clause would be lawful or enforceable if part of it were deleted, that part will be deemed to be deleted, and the rest of the Clause will continue in effect (unless that would contradict the clear intention of the parties, in which case the entirety of the relevant Clause will be deemed to be deleted).
- 11.3 The Licensor may freely assign this EULA and/or its rights and/or obligations under this EULA without the Licensee's consent. Save as expressly provided in this EULA, the Licensee must not assign, transfer, charge, license or otherwise dispose of or deal in this EULA and/or any its rights and/or obligations under this EULA.
- 11.4 This EULA is made for the benefit of the parties, and is not intended to benefit any third party or be enforceable by any third party. The rights of the parties to terminate, rescind, or agree any amendment, waiver, variation or settlement under or relating to this EULA are not subject to the consent of any third party.
- 11.5 This EULA constitutes the entire agreement and understanding of the parties in relation to the subject matter of this EULA, and supersedes all previous agreements, arrangements and understandings between the parties relating to the subject matter of this EULA. Subject to Clause 8.1, each party acknowledges that no representations or promises not expressly contained in this EULA have been made by or on behalf of the other party.
- 11.6 This EULA will be governed by and construed in accordance with the laws of England and Wales; and the courts of England will have exclusive jurisdiction to adjudicate any dispute arising under or in connection with this EULA.