

Chapter 13: Positioning Using Range/Range Devices

WinFrog provides you with the capability to utilize **range/range** (R/R) devices for vehicle positioning. As the name implies, **range/range** devices utilize range (i.e. distance) measurements to derive positions. To resolve a position with no ambiguity, ranges must be measured to at least 3 control stations (points of known coordinates). In some range/range systems (such as Racal's MicroFix), the coordinates of the control stations are entered internally into the transceiver console, where an internal program then uses the observed ranges to calculate and, ultimately, output a position. WinFrog replaces these internal calculation routines, combining the raw ranges received from the transceiver unit with internally configured control station coordinates to calculate the final position.

This ability provides the flexibility to use two common (simpler) types of ranging systems (Syledis and Trisponder), as well as being able to better monitor the quality of the positioning derived by the system.

Additionally, using WinFrog to calculate the position provides the ability to apply Kalman or Median filtering to the data. In addition to this control, when using Kalman filtering, you can select the option of inputting the range data itself to the Kalman filter or the least squares position solution.

Working Control Station File

As mentioned above, the basis of **range/range** positioning is the measurement of ranges to control points of known coordinates. In WinFrog, control point information is found in the **Working Control Stations (.cls)** file. (The terms **Control Point** and **Control Station** are used interchangeably here). Before a range/range system can be used with WinFrog, you must create a **Working Control Stations** file, then add the appropriate **Control Station** information to that file.

See the **Creation of a Working Control Station** file in the **Working Files** chapter for complete details on creating a **Working Control Stations** file and adding **Control Station** information to that file.

Range/Range Devices

The application of range/range device data to a WinFrog vehicle requires the same configuration steps as any other real-time device: you must first add the device to WinFrog, “generically” configure the device (if possible - not required for range/range devices), then add the device to the appropriate vehicle and configure the device for that specific vehicle.

See the **Peripheral (I/O) Devices** chapter for more information about using and configuring peripheral devices with WinFrog.

To Add a Range/Range Peripheral I/O Device

- 1 From the **Configure** menu, choose **I/O Devices... > Add**.
- 2 From the **Add Devices** dialog box, select the “+” beside **RANGE/RANGE**.
- 3 Double-click on the desired option.
- 4 Configure the various parameters in the **Device I/O Parameters** dialog box to suit the range/range device.

The device must also be configured properly to output the correct data required by WinFrog. Refer to the manufacturer’s manual for directions. It is necessary to configure the unit to output range data.

The Syledis SR3 can also be configured to output a position in either geographic (latitude and longitude) or map projection (Northing and Easting) coordinates. WinFrog supports both ranges and positions output from the Syledis. It is important to note that the range data from the Syledis SR3 are to the nearest meter, while the Trisponder range data are output to decimeter level accuracy.

- 5 Click **OK** to close the **Device I/O Parameters** dialog window.
- 6 If not already enabled, select **View > I/O Devices**. Highlight the newly added range/range device and view the **Decoded Data** to make sure that range data are, in fact, being received correctly.

To Add a Range/Range I/O Device to a Vehicle

- 1 Make sure that the range/range device has been correctly added to WinFrog, as detailed in the section immediately above.
- 2 Open the **Configure Vehicle-Devices** window for the desired vehicle. This can be accomplished in two ways:
 - 2a With the mouse pointer located within the limits of the **Vehicle Text** window

(and with the appropriate vehicle data displayed in this window) click the right mouse button. Select the **Configure Vehicle-Devices** option.

Or

- 2b From the main menu select **Configure > Vehicles**. Highlight the appropriate vehicle, then select the **Configure Vehicle-Devices** button.
- 3 Ensure that the **Data Source** for this vehicle is set to **Real-Time**.
- 4 Click the **Add** button on the right side of the **Configure Vehicle Devices** dialog box.

All **I/O Devices** that have been added to WinFrog are displayed in the **Available Data Items** list in the **Selected Data Items** dialog box.

- 5 Select the **Range/Range** device.
- 6 Click **OK**.

The selected range/range device now appears in the **Devices** list at the bottom of the **Configure Vehicle Devices** dialog box.

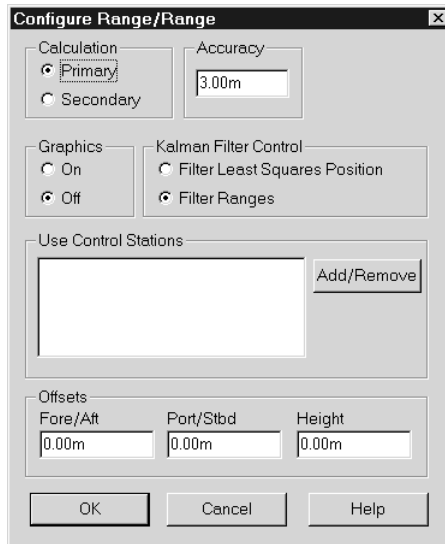
Configuration of a Range/Range Device

As per all **I/O Devices**, once the range/range device has been added to a vehicle, it must be configured for that specific application. This configuration is accomplished via the **Configure Vehicle-Devices** dialog box.

To Configure the Range/Range Device

- 1 Open the **Configure Vehicle-Devices** dialog box. (See steps **2a** and **2b** in the section immediately above for instructions on accessing the **Configure Vehicle-Devices** window.)
- 2 Select the **Range/Range** device displayed in the **Devices** list at the bottom of the **Configure Vehicle-Devices** dialog box.
- 3 Click the **Edit** button.

The **Configure Range/Range** window opens, as seen below.



- 4 Configure the following parameters in the **Configure Range/Range** dialog box.

Calculation

Primary/Secondary

Select the appropriate option.

Accuracy

Entry field

Enter the estimated range accuracy. Do not be overly optimistic since this can impact the velocity determination. **Note:** the default of three meters is recommended for Trisponder or Syledis systems.

Graphics

On/Off

Select the **On** radio button to initiate plotting of the calculated (onboard) transponder location in the **Graphics** windows.

Kalman Filter Control

Filter Lease Squares

Position/Filter Ranges

Select how Kalman filtering will be applied to the data:

If **Filter Least Squares Position** is selected, a position is solved using the raw range data (using a least squares adjustment of the raw ranges) and the “raw” position is then put into the **Kalman Filter**.

If **Filter Ranges** is selected, the ranges are entered into the **Kalman Filter** before they are

used to calculate a position. **Note:** it is recommended that the **Filter Ranges** option is selected.

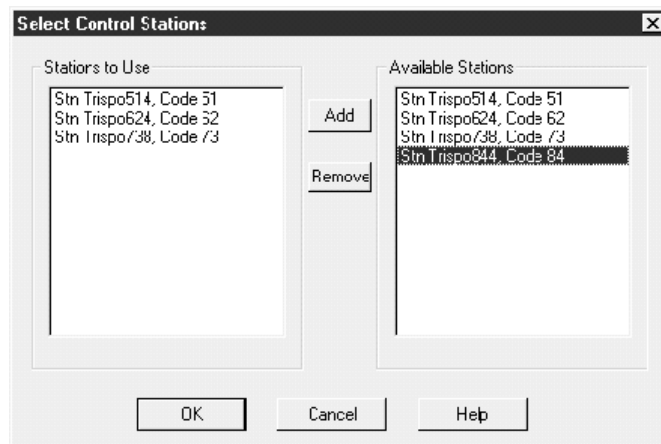
Use Control Stations

Window

This window lists the **Control Stations** currently selected for use in the position determination calculations. In order to utilize a received range, WinFrog must be able to match the **code** from a received range data string to a control station **code** in this list.

This “two step” method of Control Station selection isolates the contents of the **Control Stations (.cls)** file from those stations to be used in the solution. This is useful in those cases where you may have numerous stations configured in the **Control Station** file that are not to be used in the current calculations.

Click the **Add/Remove** button to open the **Select Control Stations** dialog box, as seen below.



Available Stations List

List

displays all control stations in the **Working Control Stations (.cls)** file. Up to eight stations can be selected for use at any one time.

To Add a Station to the Solution

Select it from the **Available Stations** list and click the **Add** button.

To Remove a Station from the Solution

Select it from the **Stations to Use** list and click the **Remove** button.

Note: even though a station is selected and displayed in the **Stations to Use** list, it remains displayed in the **Available Stations** list.

- 5 Once all required control stations have been added, click **OK**.

Offsets

Enter the **Offsets** as measured from the vehicle CRP to the onboard transponder. A sensor **Height** relative to MSL must be entered in the **Height** field. This value is used in conjunction with the **Control Station MSL Elevation** to reduce the ranges to horizontal.

- 6 Click **OK** to close the **Configure Range/Range** dialog box once it has been configured satisfactorily.
- 7 Click **OK** to save the configuration changes and close the **Configure Vehicle-Devices** dialog box.

Editing Range Use in the Solution

The range data available for use in the position solution are determined by the control station selections. The actual use of the data from these control stations is controlled by several other WinFrog configuration options.

Range Gating

A “**Range Gate**” can be used to have WinFrog remove unsuitable ranges from inclusion in position calculations. The **Range Gate** configuration is found in the **Configure Vehicle-Devices** dialog box.

By default, the **Range Gate** is set to **Off**. To enable the **Range Gate** “uncheck” the **Off** box, then use the sliding bar to select the desired range gate value (this can be set to a value between 5 and 100 meters). The range data are then monitored. If a new range exceeds the expected range by the value entered in the range gate, that new range is not used in the solution for that data cycle.

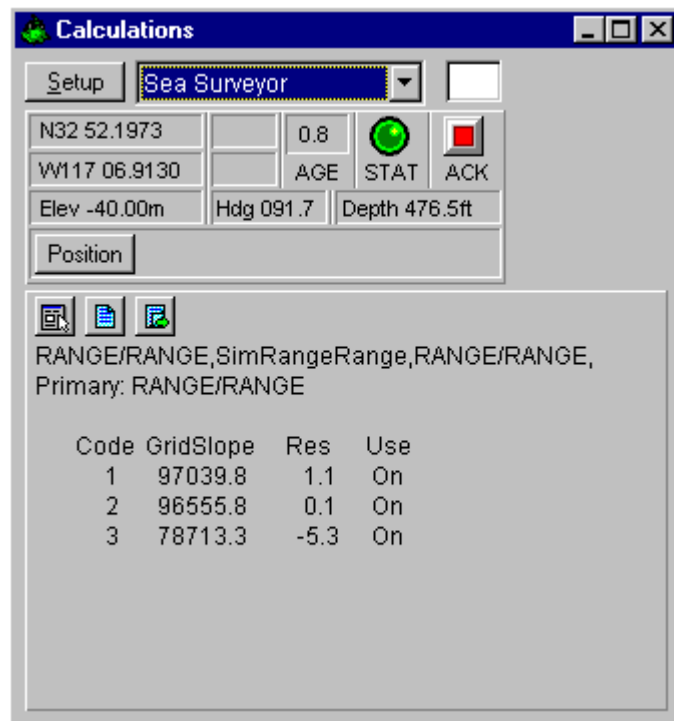
Note: selecting too small a range gate value can result in the exclusion of valid data, particularly if the vehicle’s speed is high or inconsistent.

Range Use

WinFrog’s **Calculations** window allows you to monitor range/range data and to manually add or remove ranges from the position solution as required.

To Monitor Range/Range Data in the Calculations Window

- 1 Enable the **Calculations** window (select the main menu item **View** > **Calculations**). See the **Calculations Window** section in the **Operator Display Windows** chapter for details about configuring this display.
- 2 Select the appropriate vehicle from the provided dropdown menu.
- 3 Click the **Setup** button.
- 4 In the **Included Views** section of the **Setup Calculation Views** window, select **Position** and **Data Item Text**.
- 5 Highlight the **Range/Range** device from the device listing provided.
- 6 Click on the **On** button just below the device list.
- 7 Click **OK** to close this window and return to the **Calculations** window.



The **Calculations** window now displays **Station Code**, **Grid Slope Distance**, **Residual**, and **Use status**.

The **Use** status displays one of the following:

On

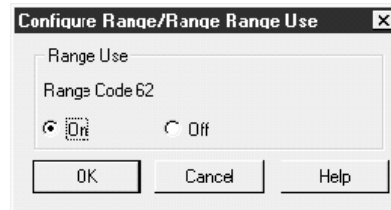
The range is enabled in the solution.

Gated

The range is **on**, but it has been gated out of the solution due to exceeding the specified range gate.

Bad	The range is turned off and is not used in the solution.
Off/Gated	The range is off and has failed the gating monitoring.

In the **Calculations** window, beside each range is an **up arrow**. Click one of these, to view the **Configure Range/Range Range Use** dialog box.



Range Use

On/Off

If the **Off** radio button is selected for a particular range code, that code is not used in the solution under any circumstances. If the **Range Gate Off** box in **Configure Vehicle Calculations** dialog box is not checked, the off range will still be monitored for exceeding the range gate limits.

If the **On** radio button is selected for a particular range code, that code is used in the solution unless it is determined to be bad (**0** in the input) or gated. In both cases, the residual is calculated and displayed.