Rhino3

manual version 1.1

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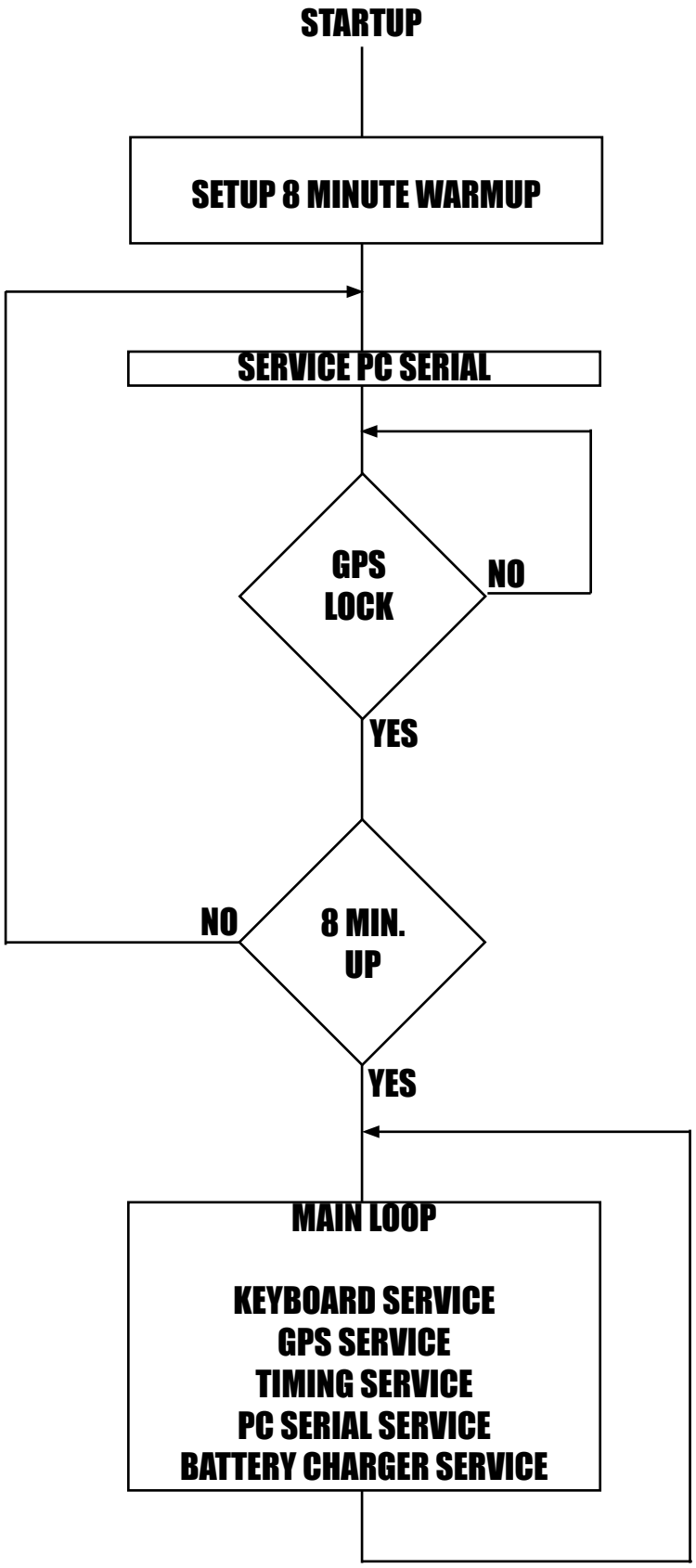
RHINO 3 POWER UP FLOW CHART



INTRODUCTION

Rhino3 is a portable frequency source that uses a GPS receiver to train an ovenized oscillator in order to provide an accurate frequency output. The accuracy of the instrument depends on the built in GPS receiver, therefore, the instrument needs to be connected to a GPS antenna at all times.

When the PPS Input option is installed Rhino3 outputs 3 buffered 10 MHz signals. A custom model is available where the PPS Input is replaced by a 4th buffered 10 MHz output. All Rhino3 models provide an input that is used to measure external frequency signals and a PPS output signal that is derived from the trained oscillator. Frequency measurement and phase measurement (when PPS Input option is installed) data can be logged on a PC using the supplied PC software. The data collected can be converted using this software into ASCII formats that are compatible with many post-processing data programs.

While the unit is on, it is always monitoring the frequency of the internal oscillator and adjusting it for best accuracy WHILE THE GPS IS LOCKED. This monitoring continues at all times, regardless of the screen being displayed or measurement selected.

GPS ANTENNA PLACEMENT

The built in GPS receiver's antenna must be placed in a position where at least 3 GPS satellites are visible. Rhino3 main screen and Rhino3 PC software provide the status of the GPS receiver. The best placement for the antenna is usually outdoors in an area where the sky is unobstructed by buildings and trees. Place the antenna in a position where the GPS stays locked most of the time. A window may work (but not provide lock at all times), however, entirely indoors will not work.

When the Rhino3 is first turned on in a new location, the GPS receiver may take up to 20 minutes to acquire lock. After this initial turn on, the GPS will lock in seconds as long as the antenna is not moved.

Removing the GPS antenna causes the Rhino3 to stop adjusting the oscillator and enter hold over (oscillator is held in present state).

BATTERY

Rhino3 can operate for up to 1 hour on its internal batteries if they are fully charged. In order to run off the battery for this length of time it must first be fully charged and the unit has to be warmed up before running off the battery. To charge the battery, use the following sequence:

NOTE: While cold, the internal oscillator drains the batteries excessively and greatly reduces the battery life.

1) Plug in the external 12v DC source.

2) If the BATTERY POWER led is blinking, press the Battery on/off button and the BATTERY POWER led goes off.

If the Battery on/off button had to be pressed, remove the DC input to turn off the unit. To charge the battery, re-connect the DC input.

3) Five minutes after the DC power is applied, the battery charge begins (CHARGE led blinks). The five minute delay is required to limit internal current. It is NOT recommended to apply DC input while the BATTERY POWER led is on.

4) Wait for the CHARGE led to stay on solid indicating a fully charged battery. To run from the battery at this time, press the Battery on/off button. The BATTERY POWER led should start to blink indicating that it is now safe to remove the DC input power.

SPECIFICATIONS

Firmware Version: 1.00
PC Software Version: 1.00

Battery Charge Time: < 3 Hour

Battery Run Time: > 1 Hour

Holdover (no GPS antenna connected): 10 usec/Hour

Output Frequency Accuracy: 1E-9

Stability: 1E-9

Input Frequency Measurement Range: 30kHz-30MHz

GPS: Internal 12 channel.

Input DC Voltage: 12V

PC Interface: RS232 Serial 1 Start/Stop Bit, 8 bit data, 9600 baud

TOP PANEL

Buttons

NOTE: The buttons do not work until GPS is locked and an 8 minute warm-up time has expired. See block diagram.

STANDBY – Future Standby Option

BATTERY ON/OFF – Turns the unit On and OFF if no DC input is present. Puts the unit in battery power pending mode when external DC input present.

LED Indicators

CHARGE – Blinking indicates that a charge cycle is in progress. Solid ON indicates that the internal battery is fully charged. Unlit indicates a timeout interval (up to 5 minutes).

LOCK – When lit, indicates that the internal ovenized oscillator is locked to the GPS.

BATTERY LOW – On indicates that the internal battery is very low. The unit should be turned off and the DC input connected at once to recharge the battery.

Note: Charging starts 5 minutes after external DC is applied.

BATTERY POWER – When this led is blinking it indicates that DC input is present and the unit is running from the DC input and the battery charge is being maintained. If the DC input is removed in this state, the unit will transition to running from the internal battery.

When this led is ON solid, the unit is running from the internal battery and no DC input is present. The unit will run until the battery is low or the battery on/off button is pressed. When this led is OFF, it indicates that the battery power on/off switch is in the OFF posi-

tion.

KEYS

ENTER/SELECT
SETUP
MENU UP
MENU DOWN

Common to ALL Rhino 3 screens

Regardless of the screen displayed by the Rhino 3, the ovenized oscillator is constantly adjusted IF THE GPS is locked. In addition, the last measurement selected (frequency or phase) is continued even if a different screen is selected.

Press the SETUP button to enter the Rhino 3 Setup Screen.

Rhino 3 Setup Screen

Option	Rhino III Setup
1	GPS Time
2	UTC Time
3	Resync PPS
4	Measure Frequency
5	Measure Phase
6	Adjust Contrast

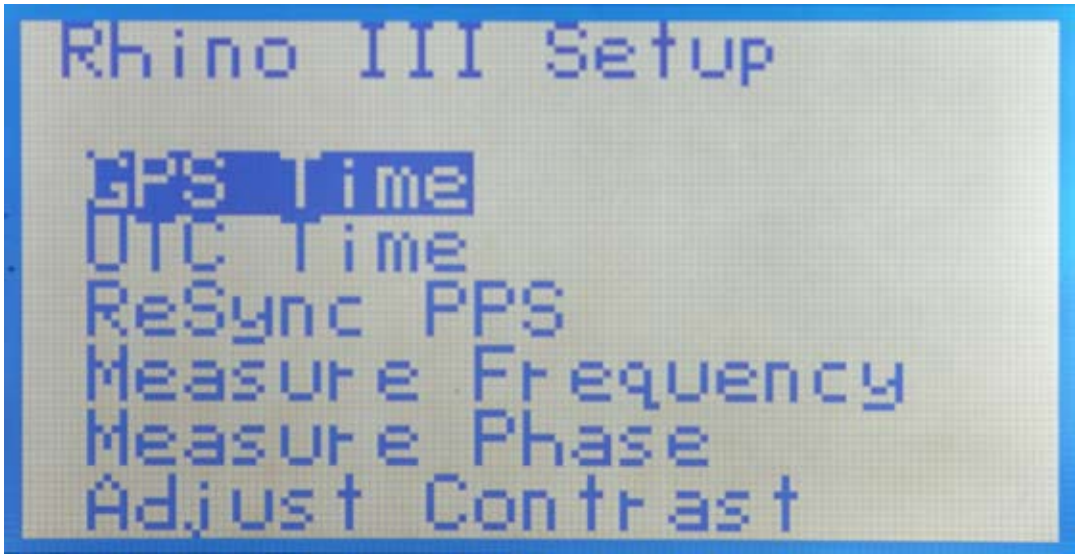


Figure 1

Use the MENU Up and Down keys to highlight the desired setup option. When this selec-

tion is highlighted, press the Enter/Select key. For Option 1 through 5 in Figure 1, pressing the Enter/Select key sets that feature On. Option 4 and 5 cause the display to change to new measurement screens. Pressing Enter/Select when option 6 is highlighted causes the Contrast Adjust Screen to be displayed.

SETUP OPTIONS

GPS Time – The GPS receiver is changed to GPS Time and this time is displayed in the main screen and saved to disk.

UTC Time – The GPS receiver is changed to UTC Time and this time is displayed in the main screen and saved to disk.

Resync PPS – The Rhino 3 Output PPS and internal pps are resync'ed to the GPS pps.

Measure Frequency – change the displayed measurement to the Frequency Input Measurement.

Measure Phase – change the displayed measurement to the Phase Input Measurement.

Adjust Contrast – adjust contrast and/or return to the Main Screen display.

CONRAST ADJUST SCREEN

ADJUST CONTRAST

Line	
1	Up – Increase
2	Down – Decrease
3	Ent – Use

Figure 2

Use the UP/DOWN keys to Adjust the LCD Contrast. The setting selected is saved for the next power on cycle. Use the ADJUST CONTRAST screen to return to the main screen at any time by selecting the ADJUST CONTRAST setup selection and just press ENTER.

MAIN SCREEN

Line	
1	16:22:34 11/05/2004
2	3D Lock
3	Satellites 06
4	Lat: 40.5469 North
5	Lon: 74.3803 West

Figure 3

Main Screen Lines:

1 GPS Time and Date
2 GPS Lock Status
3 Number of Satellites being tracked by the GPS receiver
4 Latitude
5 Longitude

GPS Lock Status

2D – GPS is locked using at least 3 Satellites
3D – GPS is locked using at least 4 Satellites
Not Locked – GPS is not locked and no corrections being made to the ovenized oscillator.

Tracked Satellites

Use this display to determine if the Rhino 3 GPS antenna is in a good position. At least 3 satellites must be visible for the built in GPS receiver to lock. The GPS MUST BE LOCKED in order for the Rhino 3 to lock the ovenized oscillator.

FREQUENCY MEASUREMENT SCREEN

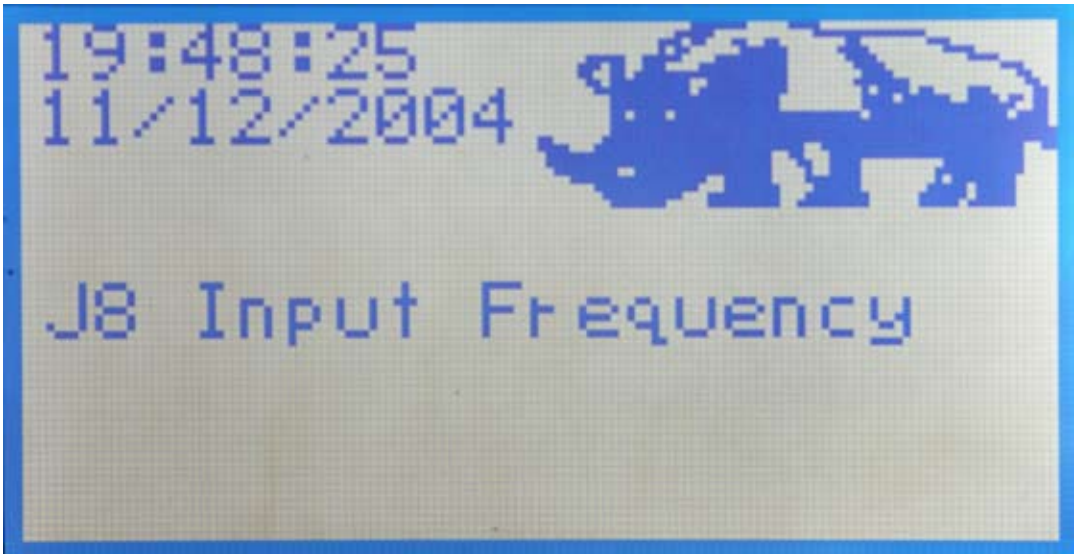


Figure 4

When this screen is displayed, the Rhino3 measures and displays the frequency connected to back panel input marked 10 MHz-IN. The data from the measurement is sent out of the serial port and can be logged with the PC software. Once this measurement has been started, it will continue even if the screen is changed and when power is resumed after the unit is shut off.

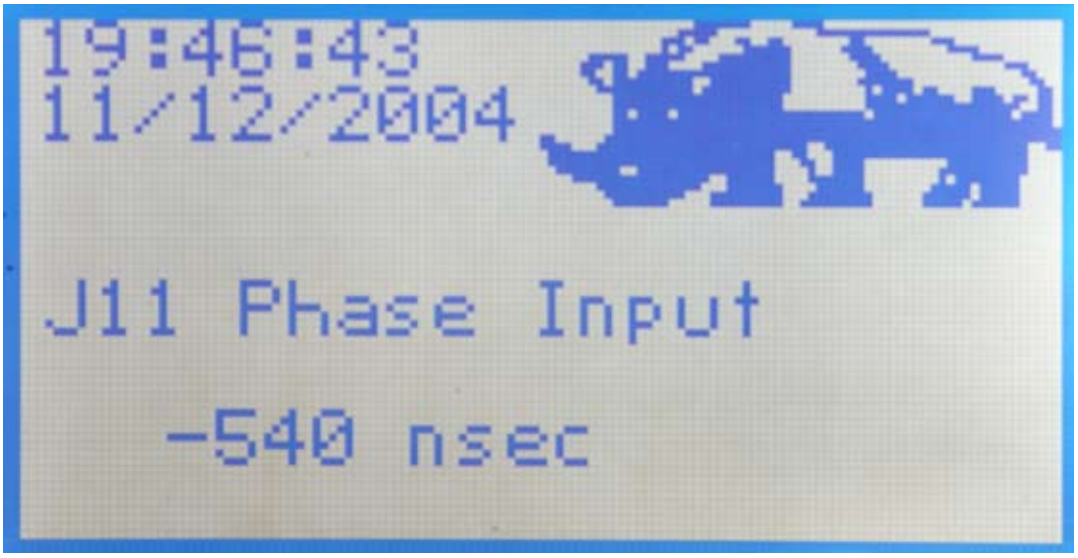


Figure 5

When this screen is displayed, the Rhino3 measures and displays the phase (in nsec) between its internal PPS and the PPS signal connected to back panel input marked 1PPS-IN. The data from the measurement is sent out of the serial port and can be logged with the PC software. Once this measurement has been started, it will continue even if the screen is changed and when power is resumed after the unit is shutoff.

PC SOFTWARE

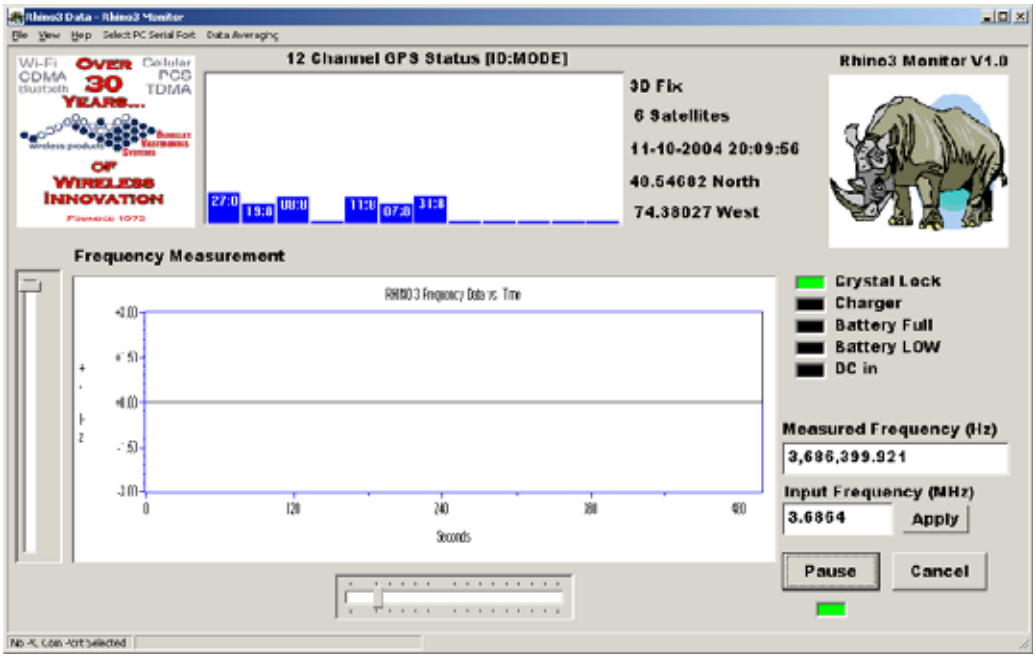


Figure 6

To use the Rhino 3 PC software, install it on the PC being used to collect data using the supplied CD. After installation, connect the Rhino3 back panel connector marked SERIAL to a PC serial port connector with the supplied cable. Run the PC software by doubling clicking

its icon (Figure 7).

Rhino 3 PC Icon
Figure 7

The screen in Figure 6 should be displayed.

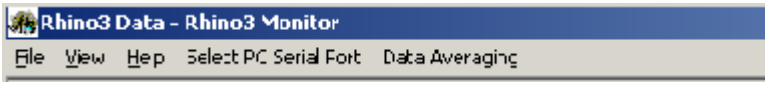


Figure 8

Use the menu on the top left of the application (Figure 8) to start a data collection disk file by clicking “File”. Choose the “Save Data File” option and enter a folder and file name for the collection file. There is no need to add a “file extension” to the name, the application will do this.

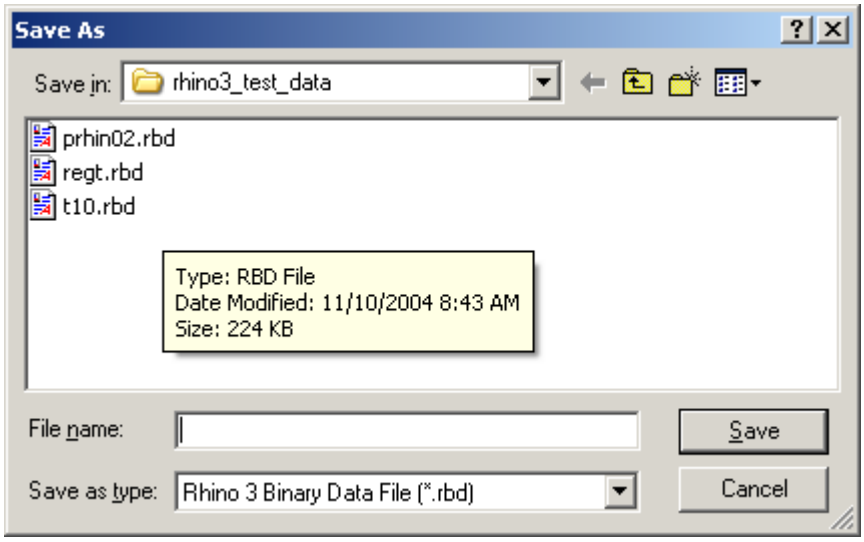


Figure 9

Figure 9 is the dialog displayed for saving a data file. It is recommended that a folder be created before running the PC application that will be used to save all RHINO 3 data files.

Choose this folder using the “Save in:” selection of the dialog.
Keeping all of the files in the same folder eases the use of the replay and convert to ASCII features of the application.

If not already done, the application must now be connected to the PC. Left Click the menu option “Select PC Port” and the following dialog is displayed (Figure 10).

Figure 10

Left Click the radio button corresponding to the PC serial port that the RHINO3 is connected to then left click "OK". The data from the RHINO3 should now be displayed. Note that the collection data file can be chosen before or after the PC serial port is selected.

Assuming that the frequency measurement was selected, the following screen is displayed (Figure 11):

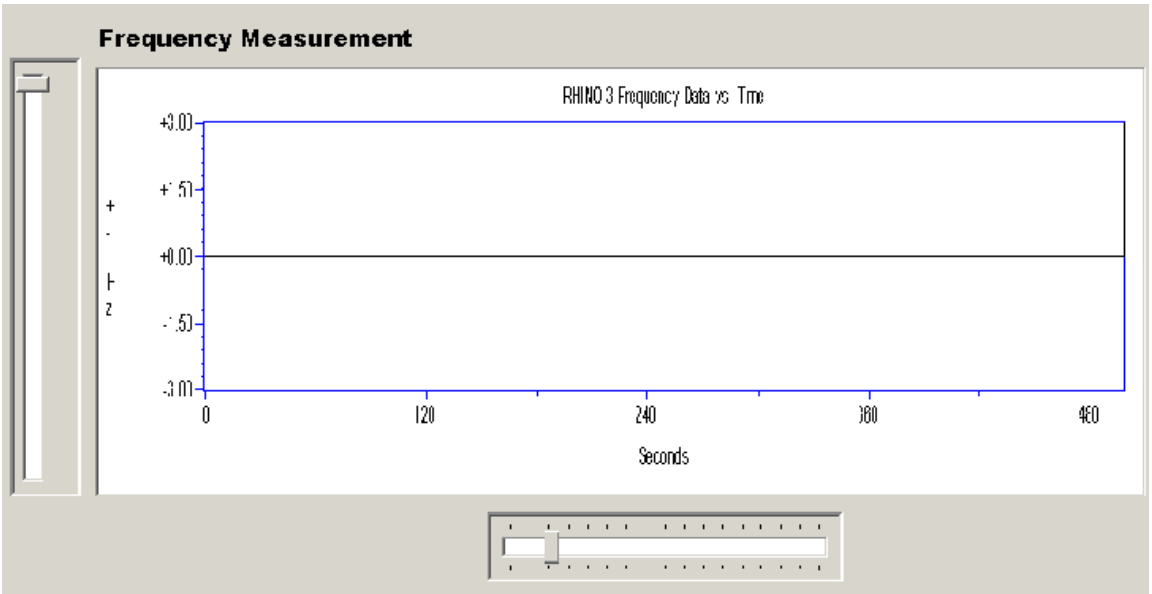


Figure 11

Figure 11 is the frequency data being measured by the Rhino 3. Use the slider on the left to adjust the scale. This adjustment has no effect on any data being saved to disk. The slider on the bottom of the graph is used only during replay. If the Phase measurement had been selected, a similar graph is displayed.

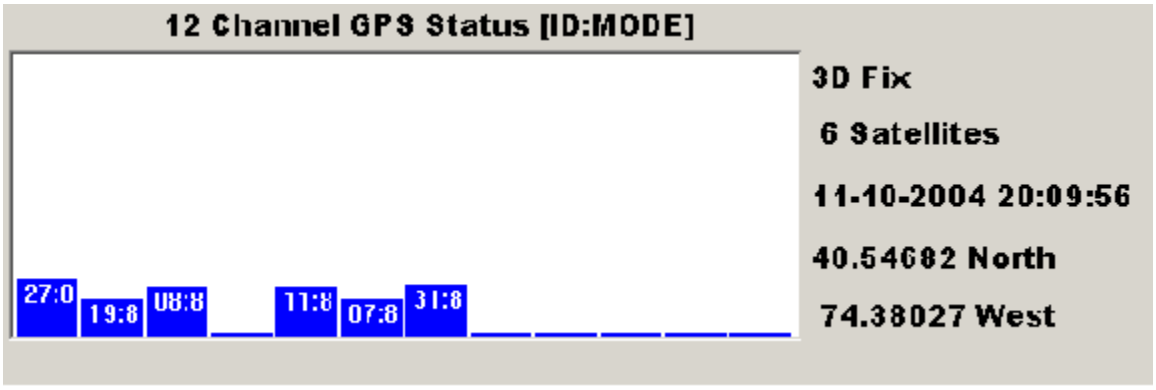


Figure 12

In addition to the data graph, the section above the graph displays the current status of the built in GPS receiver. This display can be used to trouble shoot the location of the GPS antenna.

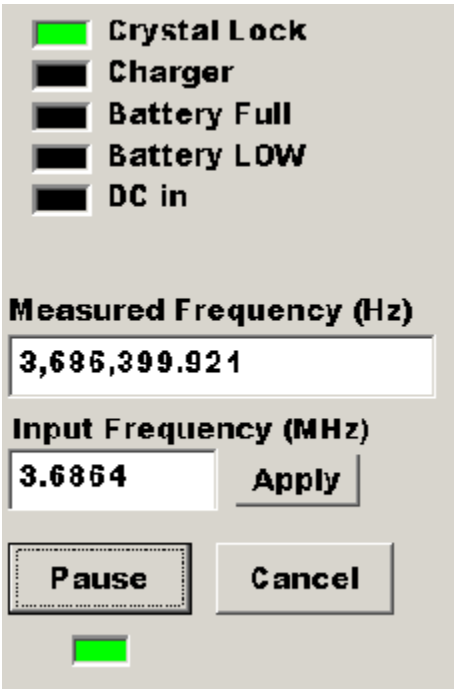


Figure 13

To the right of the graph is the RHINO 3 status display that indicates current charger and lock status. Below the status is the current measured frequency from the Rhino 3 (empty in the Phase measurement), and the center frequency entry box. The application assumes that the Rhino 3 is measuring 10 MHz. If the Rhino 3 is measuring a different frequency (such as 3.6864 MHz as shown in Figure 13), this frequency must be entered in the edit box (in MHz). After entry, right click the "Apply" button. The center frequency ONLY effects the display of

the data in the graph.

The "Pause" and "Cancel" buttons are used by replay.

Replay of Data and ASCII conversion

Use the menu on the top left of the application (Figure 8) to start a data replay by clicking "File". Choose the "Replay File" option. After selecting, the dialog in Figure 14 is displayed. Use this dialog to choose (right click the file name displayed in the dialog) to be replayed (and converted to ASCII).

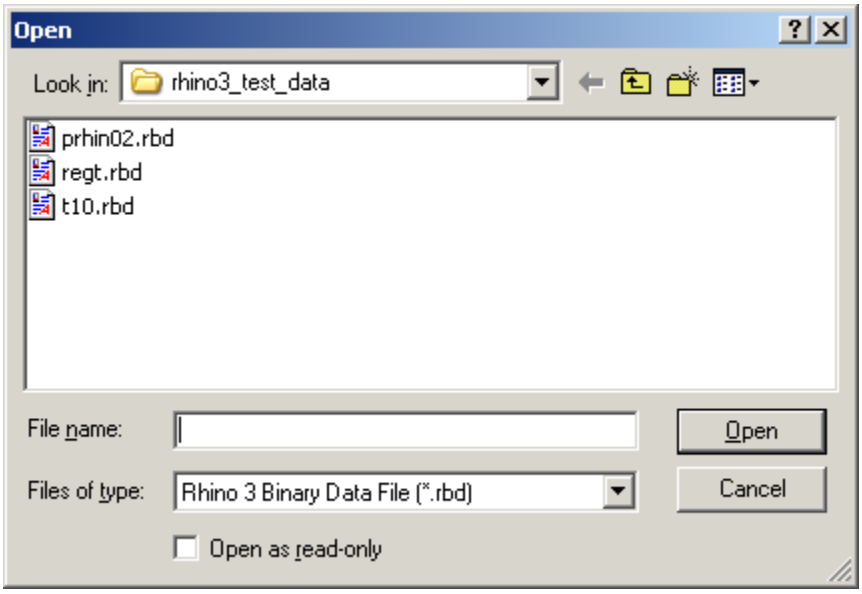


Figure 14

After choosing the file to be replayed the application displays the following dialog:

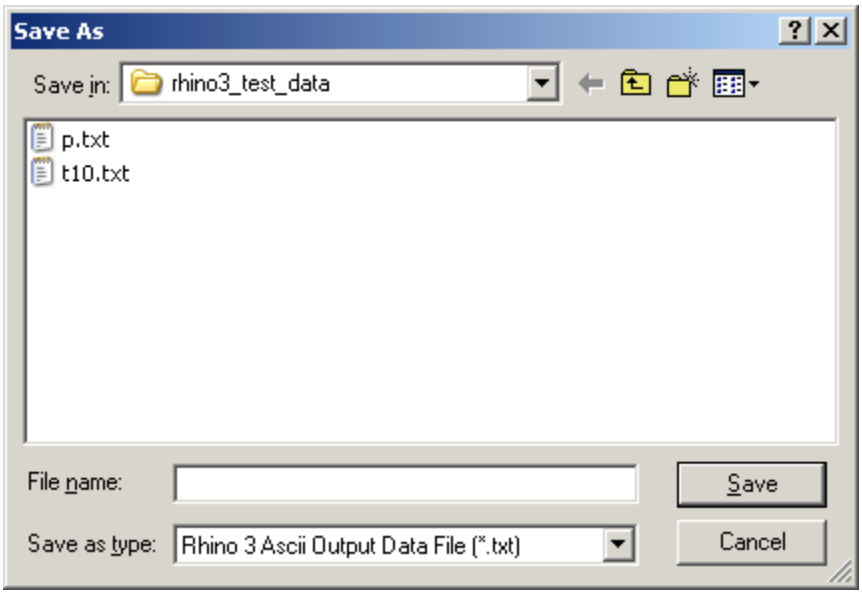


Figure 15

To just replay the data in the file selected, left click the "Cancel" button in this dialog (Figure 15). To convert the selected file to ASCII, enter a file name (the extension "txt" will be added by the application) and left click the "Save" button.

At this point, the selected file is replayed. Use the "Pause" button to halt the replay (when paused, the indicator below the pause button is green). Re-click the pause button to resume the replay.

Click the "Cancel" button next to the "Pause" button to stop the replay. Note that ASCII conversion is stopped either after the entire file is replayed OR the cancel button is clicked.

After a file is replayed, the slider below the graph can be used to scroll through the data.

PC SOFTWARE ASCII OUTPUT FORMATS

The ASCII data format for both Frequency and Phase measurement contain the following comma delimited data fields (as examples in Figures 16 and 17 show):

Field	Data
1	Date
2	Time
3	Integer Time (seconds since midnight)
4	MHz or nsec data (Frequency or Phase)

The integer time is computed as follows:

Integer Time = (Hours * 3600) + (Minutes * 60) + Seconds

FREQUENCY MEASUREMENT

```
11-10-2004,13:28:42,48522,10.000000
11-10-2004,13:28:43,48523,9.999999
11-10-2004,13:28:44,48524,10.000000
11-10-2004,13:28:45,48525,10.000000
11-10-2004,13:28:46,48526,10.000001
11-10-2004,13:28:47,48527,10.000000
11-10-2004,13:28:48,48528,10.000000
11-10-2004,13:28:49,48529,10.000000
11-10-2004,13:28:50,48530,10.000000
11-10-2004,13:28:51,48531,10.000000
11-10-2004,13:28:52,48532,10.000000
11-10-2004,13:28:53,48533,10.000000
11-10-2004,13:28:54,48534,10.000000
11-10-2004,13:28:55,48535,10.000000
```

11-10-2004,13:28:56,48536,9.999999
11-10-2004,13:28:57,48537,10.000000
Figure 16

PHASE MEASUREMENT

11-10-2004,13:49:20,49760, 50.00
11-10-2004,13:49:21,49761, 50.00
11-10-2004,13:49:22,49762, 50.00
11-10-2004,13:49:23,49763, 50.00
11-10-2004,13:49:24,49764, 50.00
11-10-2004,13:49:25,49765, 50.00
11-10-2004,13:49:26,49766, 50.00
11-10-2004,13:49:27,49767, 50.00
11-10-2004,13:49:28,49768, 50.00
11-10-2004,13:49:29,49769, 50.00
11-10-2004,13:49:30,49770, 40.00
11-10-2004,13:49:31,49771, 50.00
11-10-2004,13:49:32,49772, 50.00
11-10-2004,13:49:33,49773, 50.00
11-10-2004,13:49:34,49774, 60.00
11-10-2004,13:49:35,49775, 60.00
11-10-2004,13:49:36,49776, 70.00
11-10-2004,13:49:37,49777, 70.00
11-10-2004,13:49:38,49778, 90.00
Figure 17