TABLE OF CONTENTS

Chapter 1: Introduction 3
About BioRadio™ 3
Package Contents 4
Minimum System Requirements 4

Chapter 2: Installing Software and Setting Up Hardware 5
Installing the BioRadio Capture Software 5
Connecting the Receiver 6
Connecting the Transmitter 7
Inserting or Replacing the Batteries 7
Using the Programmer & Test Pack 7
Using the Sensor Cable 8

Chapter 3: Recording Physiological Data 9
Introduction to Using BioRadio Capture Software 9
Starting the BioRadio Capture Program 9
BioRadio Capture Window 10
Menu Bar 11
Tool Bar 11
Scale Control 11
Display Graph 12
Status Bar 12
Setting Capture Options 13
Testing the Equipment 14
Starting Capture Mode 15
Changing the Display 16
Saving Data to a File 20
Closing a File 21
Configuring the BioRadio 22

Chapter 4: Viewing, Printing & Exporting data 31
Starting View Mode 31
Viewing Saved Files 31
Changing the Display 32
Searching through Data 32
Printing Data 32

Chapter 5: BioRadio Command Reference 35
File Menu 35
Save Data to File 35
Open Data File 36
Close File 36
Export Data File 36
Capture Mode 36
View Mode 37
Print 37
Capture Options 37
Exit BioRadio 38
View Menu 39
Timescale 39
Channels 40
Filters 40
Grid 40
Toolbar 40
Scale Control 40
Status Bar 41
Help Menu 41
Contents 41
Index 41
Product Support 41
About BioRadio… 41
Getting Help with BioRadio 42

Chapter 6: Troubleshooting & Frequently Asked Questions 43

Specification Sheet 46
FCC Compliance 48
Trademark Acknowledgments 48
Software License Agreement 49
Software Limited Warranty 50
Product Limited Warranty/Returns 51
Customer Support 51
GLOSSARY 52

Chapter 1: Introduction

About BioRadio™

The BioRadio™ Model 110 incorporates state-of-the-art wireless technology for viewing and recording physiological signals such as EEG, ECG, EMG, EOG, and PSG (polysomnograph) signals. This 8-channel general purpose signal monitor is the most unobtrusive, flexible, and convenient way of measuring and transmitting physiological signals. Subjects can now be untethered and are free to roam about a ward or home while real time data is collected and displayed. Potential applications of this small lightweight wireless monitor are in biomedical, physiological, and psychological research and clinical studies involving human subjects as well as laboratory animals. Animals and small children no longer need to be restrained for fear of being entangled in their wires.

The BioRadio Model 110 wireless physiological signal monitor consists of a Transmitter, a Receiver Assembly (the receiver, receiver cable, and power supply), accessories (Sensor cable, mounting band, electrolyte gel, screwdriver, batteries, and Programmer & Test Pack), and a PC Operator Interface Software program.

The Transmitter collects signals from electrodes attached to the subject, performs analog-to-digital conversion, encoding, formatting, and transmitting of all signals. The signals are communicated using a 902-928 MHz radio transmitter. Over one hundred transmitters can be used in the same area without interference with one another. The Receiver Assembly receives the transmitted data packets, performs extensive error detection and correction, and then sends the data through a Receiver cable to the PC Operator interface where the data can be stored, monitored in real time, or analyzed at a later time.

The BioRadio Capture program consists of several software components which allow the user to acquire, store, view, and export physiological data as acquired by the BioRadio Transmitter. The software provides a simple graphical interface for setting up and controlling data acquisition. In addition, several functions are available to allow data acquired from the BioRadio Transmitter to be used in other software applications, such as Matlab®, Excel, etc. The BioRadio Configuration Wizard allows customization of the number of input channels (1-8), ranges (micro– to millivolts), and sampling rate. Configurations can be saved allowing the user to program the BioRadio for numerous applications.

This device is not FDA approved to market and is available for non-medical use only unless it is to be used in an IRB approved program.

Package Contents

Please check first to make sure your kit has the required components:

- ❒ Transmitter Unit
- ❒ Programmer & Test Pack
- ❒ Receiver Unit
- ❒ Receiver/Programmer data cable (3 feet)
- ❒ Serial cable for extension (9 pin - 9 pin, 6 feet)
- ❒ Sensor cable
- ❒ 9-volt battery adaptor wire plug
- ❒ Electrolyte gel
- ❒ AC Power adaptor for Receiver
- ❒ Two AAA alkaline batteries
- ❒ 9-volt battery
- ❒ Adjustable velcro Mounting Band (36”)
- ❒ Screwdriver
- ❒ BioRadio™ Capture Installation Software (2 diskettes)
- ❒ User’s Guide
- ❒ Warranty Form (separate from User Guide)

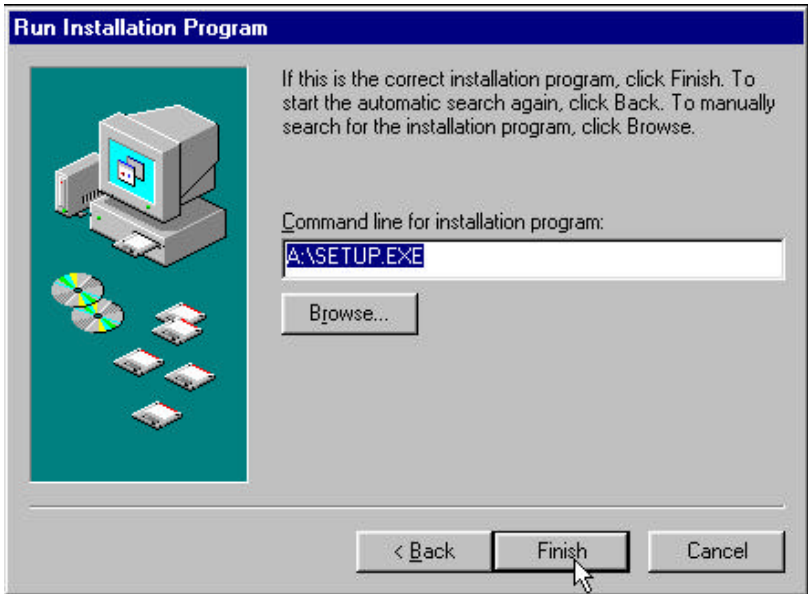
Minimum System Requirements

- Personal computer with Pentium™/MMX™ 200 MHz or higher processor (or equivalent);
- Microsoft® Windows 95, Microsoft Windows 98, or Microsoft Windows NT Workstation version 3.51 or higher;
- 16 MB of installed memory for use on Windows 95 or Windows 98, 32 MB for use on Windows NT;
- Minimum 50 MB free hard disk space (100 MB recommended);
- One 3.5” high-density floppy disk drive;
- VGA or higher resolution video adapter (SVGA 256-color recommended);
- Mouse or other pointing device;
- One free RS-232 serial port

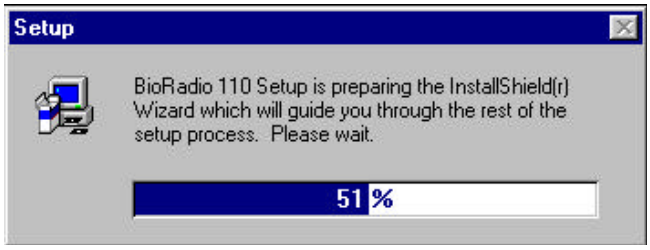
Chapter 2: Installing Software & Setting-up Hardware

Installing BioRadio Capture Software

1. Close all Windows programs.
2. Place INSTALL DISK #1 in your floppy drive (usually A:).
3. Click the **Start Button** and choose **Settings** and click on the **Control Panel** Folder.
4. Double click the **Add/Remove Programs** icon.
5. Click on **Install** in the Add/Remove Programs Properties box.
6. Click on the **Next** button.
7. When your PC finds the file **A:\SETUP.EXE** on your floppy drive, Click **Finish.**



8. Follow the onscreen instructions to complete the installation.



Connecting the Receiver

1. Connect the Receiver to a laptop or desktop computer using the Receiver data cable. The small end of the 3-foot cable fits into the jack on the bottom of the Receiver. You will hear two clicks when properly attached. The 9-pin end fits into your computer's available RS-232 serial port. Use the 6-foot DB-9 extension to add length to the 3-foot cable.

   Note which port is used; (COM1, COM2, etc.) for configuration of the software. Refer to your PC's manual for information on setting up COM ports.

   If the only available port is a 25-pin port, you will need to use a 25-9 pin adaptor (not provided but available at most electronic stores).

To RS-232 serial port

To power supply

2. Power the Receiver by:
   - plugging in the AC adapter power cord (primary power source, typically used for desktop applications), **or**
   - attaching a 9-volt battery via the 9-volt battery adaptor wire plug (typically used for mobile laptop applications)

Connecting the Transmitter

To test the Transmitter Unit, you have the option of connecting the Transmitter to the Programmer/Test Pack to obtain a stable test signal of known (approximate) amplitude and frequency; or to the Sensor Cable to obtain actual physiological signals. For quicker setup we suggest using the Programmer/Test Pack first.

Inserting or Replacing the Batteries

The batteries need to be inserted into the Transmitter the first time you use your BioRadio Transmitter.

1. Open the Transmitter case using the screwdriver provided in your BioRadio kit by removing the screw on the back of the Transmitter.
2. Lift the battery cover off of the Transmitter.
3. Insert two AAA alkaline batteries, making sure poles are aligned properly.
4. Secure the cover by replacing the screw.

Using the Programmer & Test Pack

1. Plug the ribbon cable on the Programmer/Test Pack into the Transmitter's 26-pin port. The ribbon should click into the Transmitter port when connected properly.
2. Proceed to Chapter 3 to begin viewing and recording signals.

Using the Sensor Cable

1. Thoroughly clean the skin at the recording site using a mild abrasive (shave site if necessary). Swab clean with alcohol and allow the skin to dry.
2. Fill each gold electrode cup with electrolyte gel before gluing to the scalp. Electrolyte gel is not necessary if using snap-on electrodes.
3. Attach each gold electrode cup to a marked position on the scalp or body using either tape or glue or a combination of both. Glue or snap reference electrodes, black wire leads on a bony promus such as the mastoid portion of the temporal bones behind the ears. (*A universal differential channel can be converted to a single-ended channel by plugging one of the differentials into the reference lead wire.*)
4. Note the location on the scalp or body of each channel and its number which corresponds with one of eight input channels. Input Channel Names can be programmed later using the BioRadio Configuration Wizard.
5. After electrode/sensor placement is complete, connect the end of the Sensor Cable to the Transmitter's 26-pin port.
6. Wrap the adjustable velcro mounting band to a convenient location on the body, ie., the bicep of the arm, head, or waist.
7. Clip the Transmitter to the mounting band making sure the antenna is not bent. (The Transmitter can also be mounted to a shirt collar, pocket, or other convenient location.)
8. Proceed to Chapter 3 to begin viewing and recording signals.

Chapter 3: Recording Physiological Data

Introduction to Using BioRadio Capture Software

The BioRadio Wireless Physiological Monitor consists of several software components which allow the user to acquire, store, view, and translate the analog signal data acquired by the BioRadio Transmitter. The software provides a simple graphical interface for setting up and controlling data acquisition. In addition, several functions are available to allow data acquired from the BioRadio Transmitter to be used in other software applications, such as Matlab®, Excel, etc.

This chapter serves as a brief tutorial designed to help you quickly begin using your BioRadio. It covers the basic tasks of capturing test signals, changing the display screen, recording the signals, and configuring the BioRadio. The BioRadio Capture Program is factory set for an EEG configuration. Thus the Transmitter and Receiver are programmed to use the BioRadio EEG configuration and will need to be reprogrammed using the BioRadio Configuration Wizard for other applications. For more detailed help on Commands refer to ***Chapter 5 : BioRadio Command Reference.***

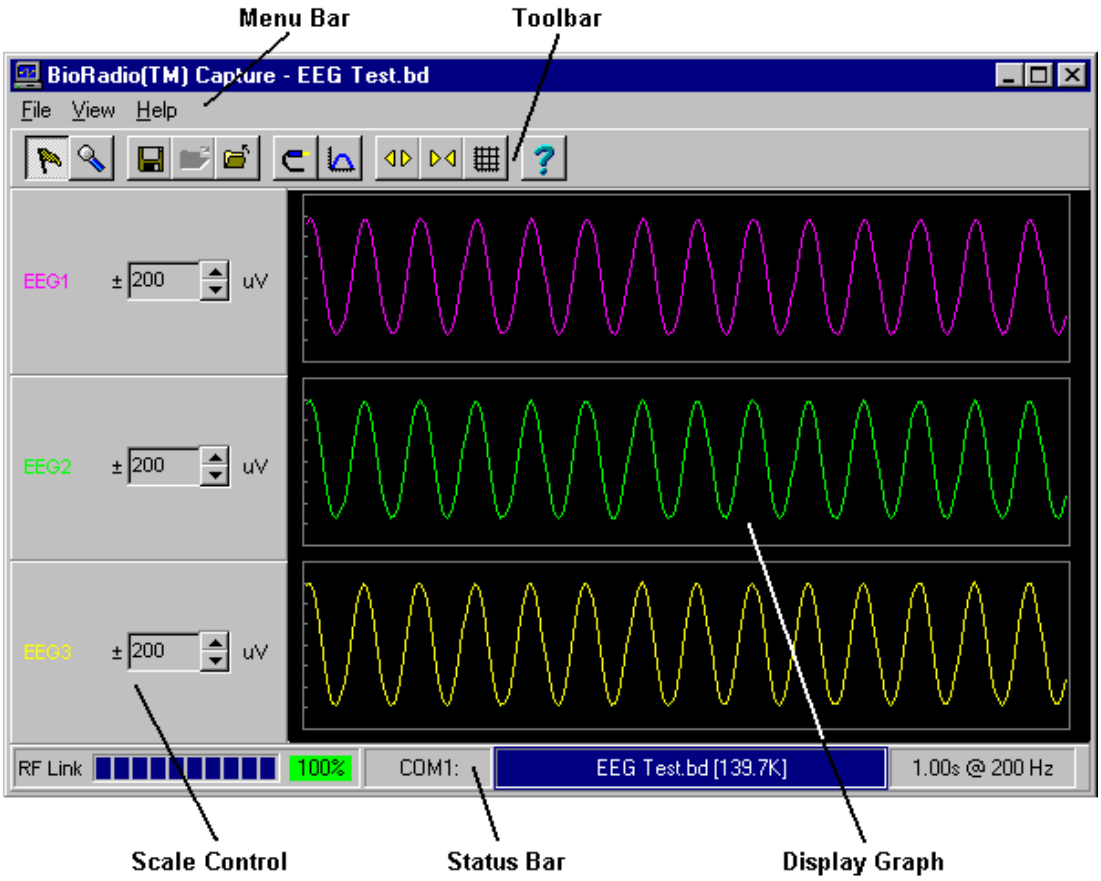
Starting the BioRadio Capture Program

1. Click on the **Start** Menu
2. Point to **Programs**
3. Point to **BioRadio** folder
4. Click on **BioRadio Capture**

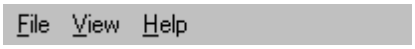
BioRadio Capture Window

The BioRadio Capture program displays physiological signals as measured by the BioRadio Transmitter in a real-time scrolling graph. Up to 8 channels can be viewed simultaneously. The graphical display can be customized: each analog channel can be scaled (Y-axis), and the time scale (X-axis) can be zoomed. The display color of each channel can be customized.

Commands can be accessed either using the drop down menus located on the Menu Bar or by clicking on the Command Buttons on the Toolbar.



Menu Bar

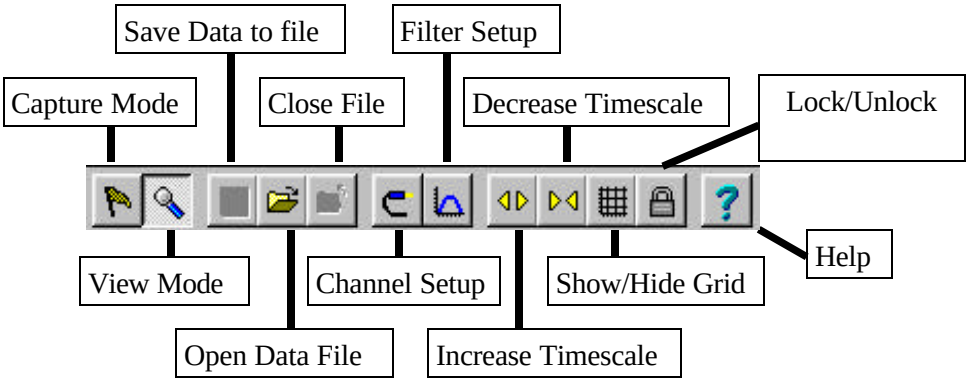
The Menu Bar 

contains the **File**, **View** and **Help** menus. The File drop-down menu has commands which allow you to open and close a file, as well as accessing other options. The View menu contains all of the screen configuration commands. The Help menu contains a search index of all of the commands and how to use them.

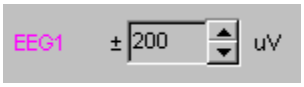
Tool Bar

The toolbar is a set of buttons and other tools, such as list boxes, that provide command shortcuts for working with BioRadio Capture. Using a toolbar button is usually quicker than choosing a command from a menu.

Pause your mouse pointer over a toolbar button to see a tooltip which defines the button's function.



Scale Control

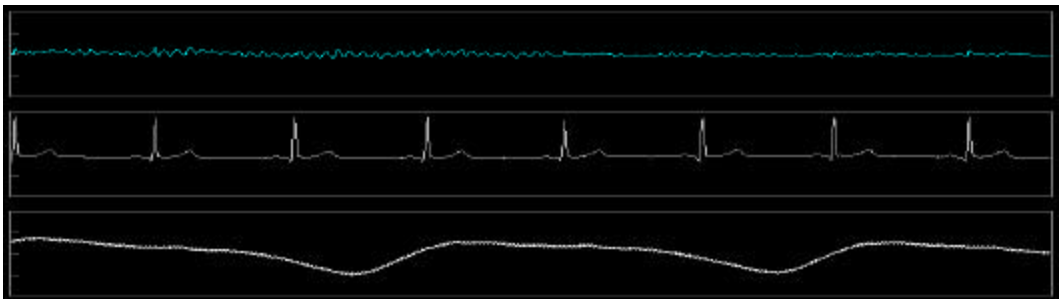


The signal from each channel may differ in the amplitude or signal strength. Each channel may be individually configured in terms of the maximum or minimum values (in micro-Volts) shown on the screen. The Scale Control allows you to adjust the displayed viewing scale in microvolts for each individual channel (*changing the scale controls does not affect how the data is stored*). Click on the **up arrow** to increase the displayed signal range (zoom-out), or the **down arrow** to decrease the range (zoom-in).

Clicking on the **Lock/Unlock Scale Controls** button on the toolbar allows you to change the scales for all channels in the Lock mode by changing only the scale on the first viewed single channel.

Display Graph

The Display Graph shows up to eight channels of physiological data either real-time data (in Capture Mode) or stored physiological data (in View Mode). You can customize which channels are viewed using the Channel Setup toolbar button. The Display Graph has a grid (which can be turned on or off) which details the viewing scale of each



channel.

Status Bar

Located at the bottom of the screen, the Status Bar provides real-time status of the data acquisition and RF link operation. This information includes:

RF Link Status: The bar graph shows an approximate measure of the signal strength from the BioRadio Transmitter. As this bar shrinks, the received signal is getting weaker, and there is greater chance for losing data. The percentage displays the current percent of received packets from the transmitter. If this number drops below 100%, RF transmission is being impeded. When this happens move the Transmitter closer to the Receiver or remove the number of obstacles between the Transmitter and Receiver.

COM Port: Displays the current serial port setting for communicating with the BioRadio Receiver. If there is a problem with the communication, this appears highlighted in red.

Output File: Displays the name of the current output file, when recording data to a file, and the file size.

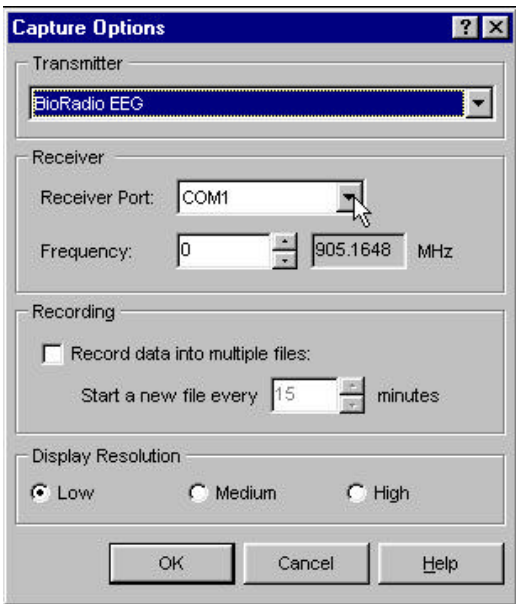
Timescale/Sample Rate: Displays the current timescale (viewing width) and the sample rate of the Transmitter.

Setting Capture Options

Before capturing data with BioRadio Capture, you must configure the BioRadio unit.

Access the **Capture Options** dialog by:

Selecting **Options…** from the File menu



Setting the Transmitter Configuration: Specify the configuration of the BioRadio Transmitter using the drop-down menu. A custom configuration can be created using the BioRadio Configuration Wizard. For your convenience, several template configurations are available for selection. **In order to use any configuration the BioRadio (Transmitter and Receiver) must be programmed to the selected configuration, see *Configuring the BioRadio*.**

Setting the Receiver Port: Make sure that the Receiver Port is set to the proper COM port (the port to which your BioRadio Receiver is attached). If you are uncertain about the COM port setting, refer to the documentation that came with your computer. Choose the correct Receiver Port using the drop-down menu (COM 1, 2, 3 or 4) and click **OK** when finished.

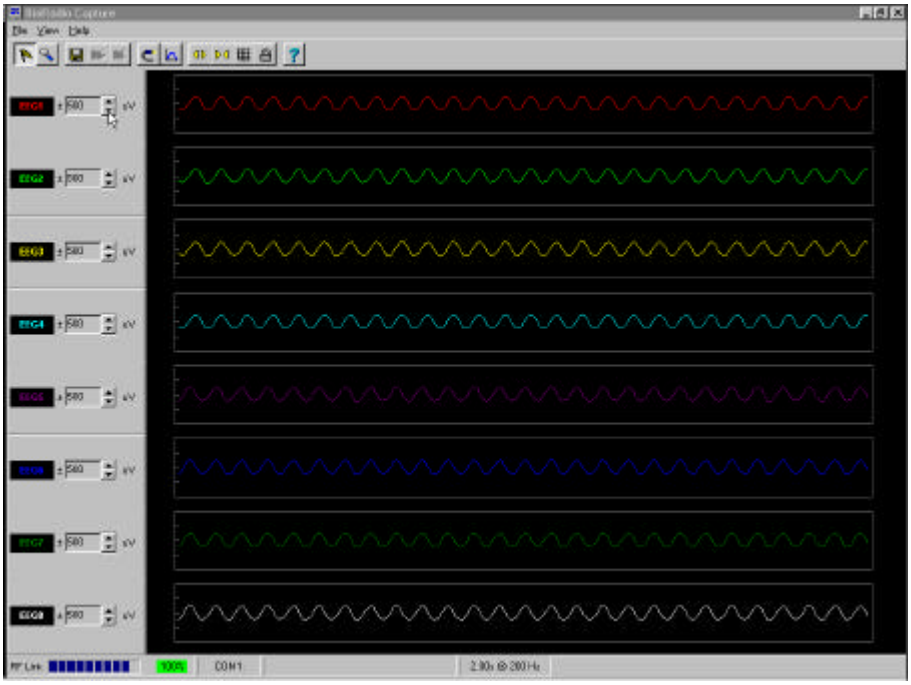
Setting the Frequency: Depending on the specific BioRadio unit you purchased, you may have to set the RF frequency for the Receiver to match the Transmitter. Refer to the documentation which was packaged with your BioRadio unit to determine the proper setting for the RF frequency. You can click on the up/down arrows to set the frequency number (and the corresponding RF frequency, in MHz, is displayed).

Click **OK** *to save the settings to be used the next time you run BioRadio Capture.*

Testing the Equipment with the Programmer/Test Pack

1. Plug the Receiver into an available RS-232 computer port using the serial port cable and connect the AC power cord (or 9V battery) to the serial port cable.
2. Check to see that the COM port is displayed on the Status Bar. It should correspond with the COM port chosen in the **File**, **Options** menu.
3. Connect the Transmitter to the Programmer/Test Pack.
4. Turn the Transmitter "**ON**" by flipping the ON/OFF switch. (The Transmitter serves as the power source to the Programmer/Test Pack.)
5. Click on **Capture Mode**.

A 12 Hz sin wave should scroll across the screen within a few seconds. If you do not receive a visible signal, refer to ***Starting Capture Mode*** or ***Chapter 6, Troubleshooting***.



5. Stop **Capture Mode** by clicking on **View Mode**.
6. Turn the Transmitter **OFF** to conserve battery power.

Starting Capture Mode

BioRadio Capture provides the ability to read and store physiological data as received from the Receiver, which has been acquired and transmitted over the RF data link by the Transmitter. When BioRadio Capture is first run, it begins in View Mode (for viewing stored data files).

If you have properly connected the Receiver and the Transmitter is ON, you are ready to View and Record either Test signals or physiological signals using the BioRadio™ Capture software.

To begin capturing real-time data, start Capture Mode by:

- Clicking the **Capture Mode** button on the Toolbar, or
- Selecting **Capture Mode** from the **File** menu.

Upon entering Capture Mode, BioRadio Capture determines if the BioRadio Receiver on the configured serial port is properly communicating. If the Receiver is connected and properly configured, the physiological data will begin scrolling across the **Display Graph**. Please note, there is a several second delay when the data will first start. You are now ready to change the display, or save data to a file.

If the port is not properly configured, or if a problem is detected with the Receiver, an error message is displayed. Refer to ***Chapter 6: Troubleshooting and Frequently Asked Questions*** for more information.

Once Capture Mode has started, the **Status Bar** provides information on the status of the RF link and data files. Notice the Status Bar will constantly update you on the Received Signal Strength and the percentage of data packets being received.

Changing the Display

Once Capture Mode is started and real-time data is visible in the Display Graph, you can alter the way the data is viewed. The changes you make to the display, filters, etc. are stored and will be used the next time you run the BioRadio Capture application.

Showing/Hiding the Grid

Show or hide the grid on the Display Graph by:

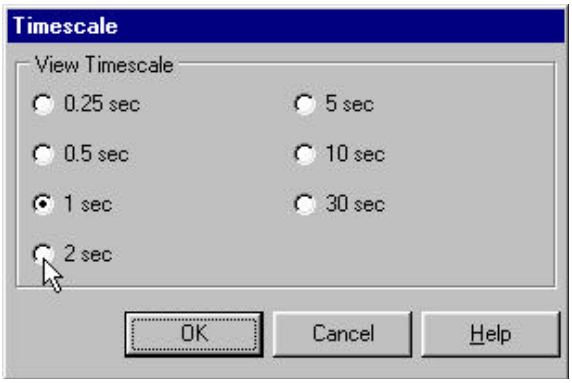
- Clicking the **Show/Hide Grid** button on the Toolbar, or
- Placing a checkmark next to **Grid** on the **View** menu.

Changing a Channel's Viewing Scale:

Use the up/down arrows on the **Scale Control** panel next to a channel to increase or decrease any individual channel's view scale in microvolts.

Changing the Time Scale:

- Clicking on the Increase/Decrease Timescale buttons on the Toolbar will increase or decrease the timescale (viewed time interval). Each click will increase or decrease the timescale by preset increments (0.25, 0.5, 1, 2, 5, 10, 30 seconds), or
- Selecting **Timescale...** from the **View** menu will display the Timescale dialog. You can select a timescale from the View Timescale buttons to specify the width of the Display Graph.



Selecting the Number of Channels to Display

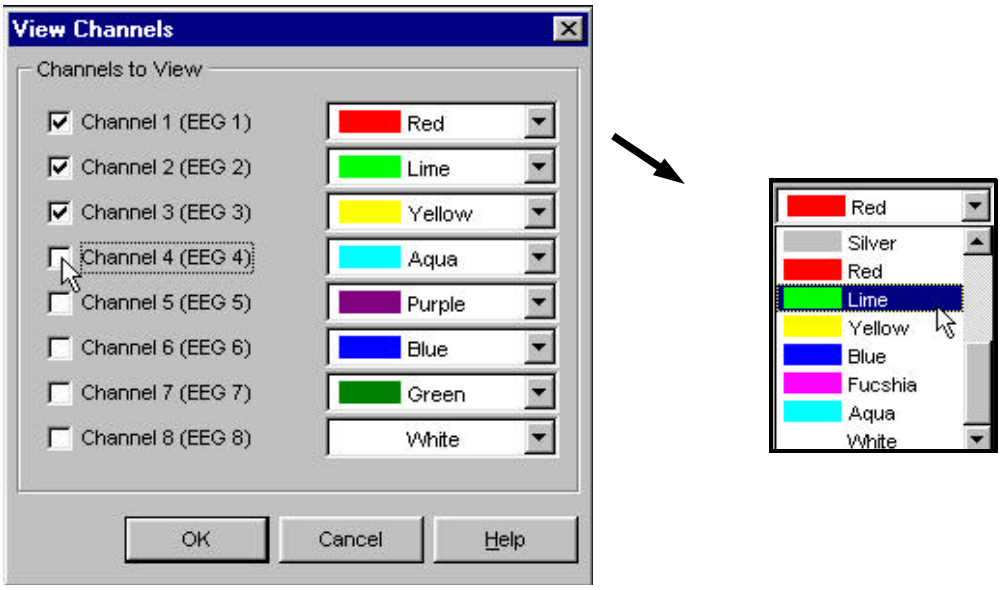
The software allows you to view all 8 channels or any combination of them.

Open the **View Channels** dialog window by:

- Clicking the **Channel Setup** button on the Toolbar, or
- Selecting **Channels** from the **View** menu.

In the **View Channels** dialog you can customize which channels to display and set the color of each channel in the Display Graph.

1. Channels listed with a check mark ✓ (next to the channel) will be shown on the **Display Graph**.
2. Customize the display color for each channel by selecting a color from the color drop down arrow to the right of each channel.
3. Click the **OK** button to implement the changes.



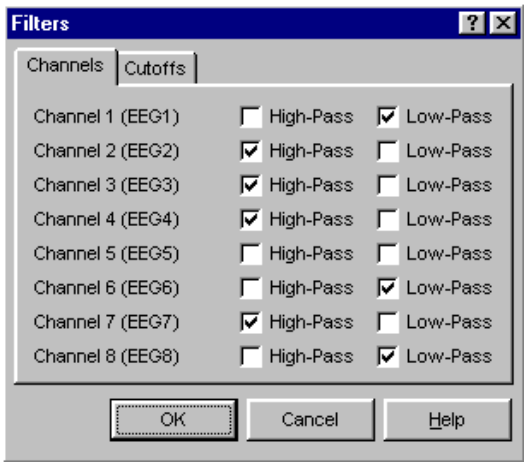
Adding Filters to a Channel

BioRadio Capture allows you to filter the data during viewing (after it has been transmitted or stored). A digital filter permits suppression of undesired signals while maximizing the visibility of the signals of interest. This process is actually implemented as separate high-pass and low-pass filters, both of whose cutoff frequencies are programmable by the software. The high-pass filter rejects DC offsets and slowly changing interference signals due to movement and other types of artifacts. The low-pass filter rejects the very high frequency portion of the acquired signal which is usually associated with unwanted and non-physiological noise. It might also be desirable to "zoom in" a portion of the frequency spectrum while the data is acquired. For example, transition of wakefulness to sleep is usually associated with changes in the alpha band of EEG (8 to 12 Hz). Therefore, it might be desirable to band-pass filter the EEG in the alpha band to monitor the onset of sleep.

The **Filters** dialog window allows you to apply filters to each input channel, and select the global filter cutoff frequencies for the high or low-pass filter. The Filters dialog window has two panes: **Channels** and **Cutoffs**.

Open the **Filters** dialog window by:

- Clicking on the **Filter setup** button on the Toolbar, or
- Selecting **Filters…** from the **View** menu.



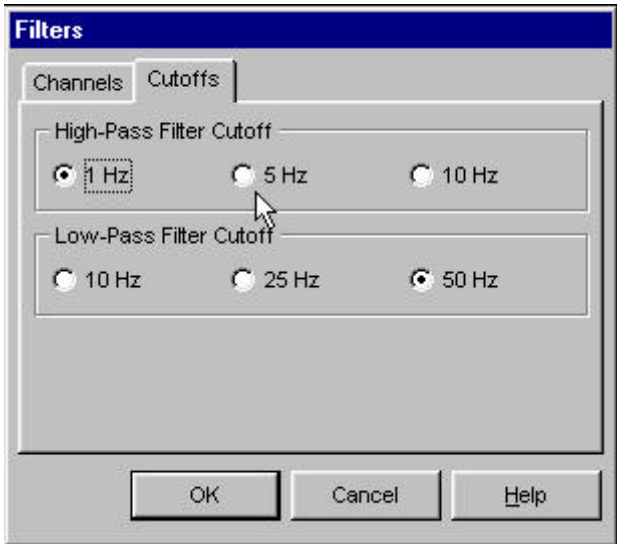
The **Channels** pane allows you to apply either a high-pass filter, low-pass filter, or both to each individual channel. Place a check mark to apply a High-pass or Low-pass filter for each corresponding channel. **High-pass filters** let higher frequency content through and attenuate lower frequencies. This can be useful for eliminating drifting artifacts and DC offsets from the data. **Low-pass filters** let lower frequency content through and attenuate higher frequencies. This can be useful for removing fast, transient responses from the data.

The **Cutoffs** pane allows you to select the exact cutoff frequency used for the High-pass and Low-pass filters applied to each channel.

High-Pass Filter Cutoff: Selects the cutoff frequency (in Hz) of the high-pass filter. (The filter is a 4th order Butterworth design, so this cutoff represents approximately a 3 dB attenuation of the input signal).

Low-Pass Filter Cutoff: Selects the cutoff frequency (in Hz) of the low-pass filter. (The filter is a 4th order Butterworth design, so this cutoff represents approximately a 3 dB attenuation of the input signal).

Use the mouse to choose which global cutoff frequency you would like for the high or low-pass filters you have added. Your choice of cutoff frequencies will vary depending on the sampling frequency which is determined by the number of input channels selected and the resolution.



Saving Data to a File

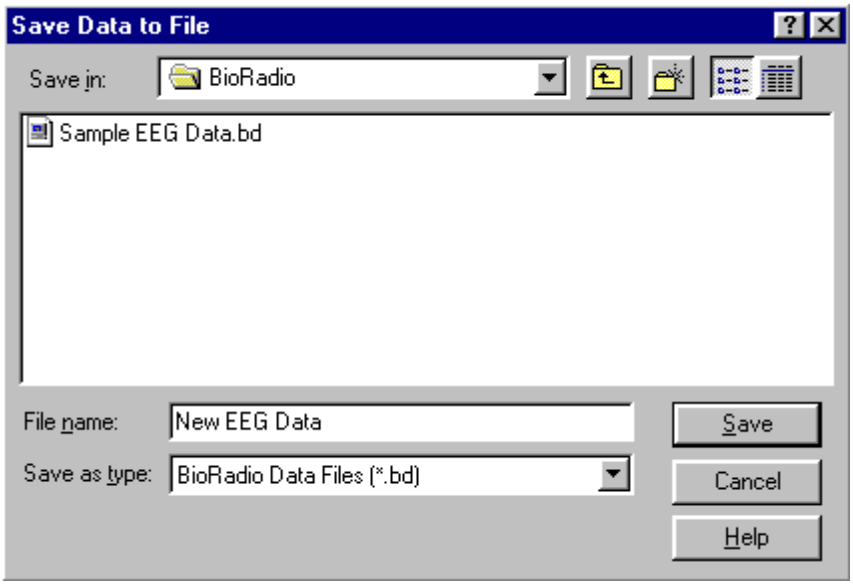
After you have made adjustments to the display graph and filters you can begin saving the data being viewed. You can alter the display at any time while saving data, as it does not affect the way the data is stored.

BioRadio Capture records the acquired data into a binary data file for off-line viewing and analysis. Due to the large amount of data that can be collected, (e.g. during a typical Sleep Study), the application can be configured to segment the data into multiple files of fixed duration for smaller file sizes and manageability. See the **Capture Options** dialog for more information about recording multiple files.

Record the data to a file by:

- Clicking the **Save Data to File** button on the Toolbar, or
- Selecting **Save Data to File...** from the **File** menu.

The **Save Data to File** dialog window appears, allowing you to specify the name, format, and location of the file to be recorded.



You must enter a file name in the **File name:** box and click the **Save** button to begin saving.

You can change the directory in which to save the file by selecting the directory in the **Save in:** box at the top of the dialog.

You can also choose the format of the file by selecting a format in the **Save as type:** box, as either BioRadio Data Files (*.bd) or ASCII Data Files (*.dat):

> **BioRadio Data Files (*.bd):** BioRadio Data files are a compact binary representation of saved physiological data, which can only be read by BioRadio Capture. In most cases, you will want to store your data in BioRadio Data files, as they are more compact and you will easily be able to view them later. If you save data in BioRadio Data format, you can later export some or all channels to an ASCII data file. See **Exporting Data** for more information on exporting data to ASCII files.
>
> **ASCII Data Files (*.dat):** ASCII data files are tab-delimited files containing all physiological channels in floating-point ASCII format. Saving the data in ASCII files allows you to directly use the data in other programs (such as Matlab®, Excel®, etc.) but ***you will not be able to view the data once it has been saved in ASCII format.***

Notice that as you begin saving data, the Status Bar at the bottom of the screen displays the continuous change in file size and the current file name which flashes to indicate that a file is being recorded.

Closing a File

Once a data file has been opened in Capture Mode, you can stop recording to the file by:

- Clicking the **Close file** button on the Toolbar, or
- Selecting **Close file** from the **File** menu.

Configuring the BioRadio

The Configuration Wizard allows you to configure the BioRadio Model 110 Transmitter and Receiver to record different physiological signals. The software allows you to create or use an existing configuration to program the BioRadio using the Programmer & Test Pack Unit. *Please note that the BioRadio Capture Program should not be open while using the Configuration Wizard and vice-versa.*

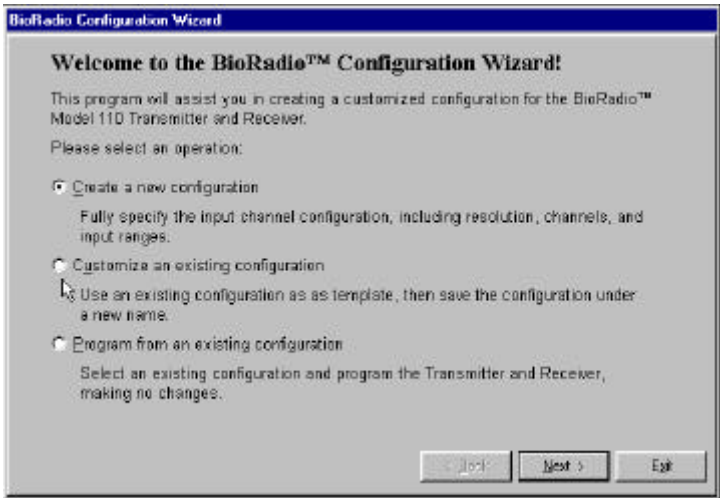
Starting the BioRadio Configuration Wizard

1. Close BioRadio Capture Program
2. Click on the **Start** Menu
3. Point to **Programs**
4. Point to **BioRadio** folder
5. Click on **BioRadio Config Wizard**

The Configuration Window opens allowing you to program the BioRadio in three ways:

- Create a new configuration
- Customize an existing configuration
- Program using an existing configuration

After choosing the type of configuration, The Configuration Wizard will take you step by step through the process of programming the BioRadio using either a created or existing configuration.

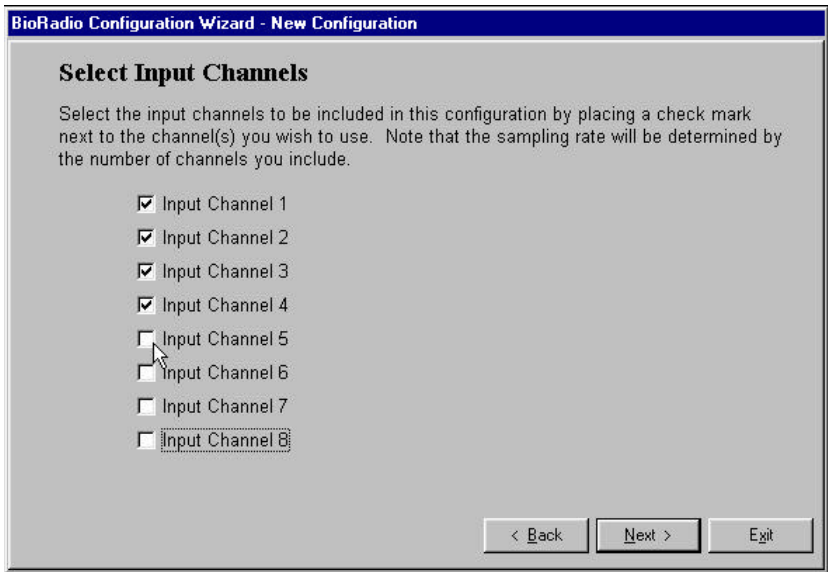


If you choose to create your own configuration, either starting from a new or existing configuration template, several features will need to be selected or changed:

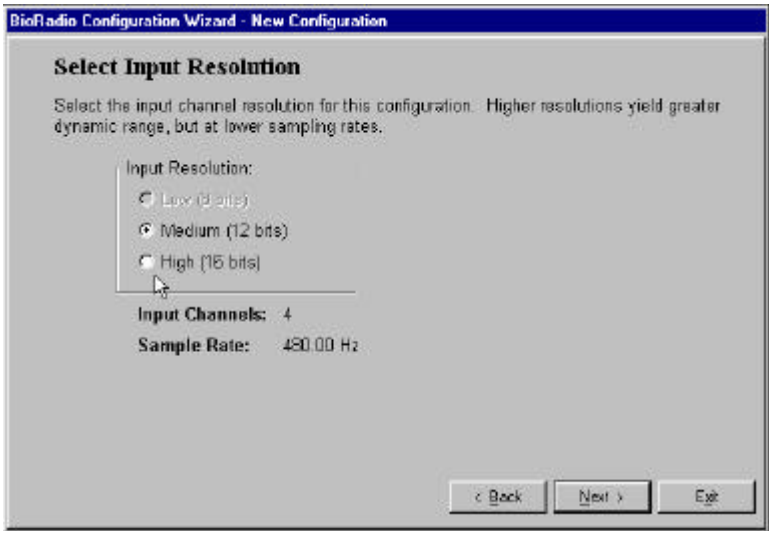
- **Input Channels** to be used
- **Input Channel Resolution**
- **Input Channel Ranges** in micro to millivolts
- **Input Channel Names** for software display graph
- **Name Configuration**

Selecting Input Channels to be used:

Enable each input channel you wish to use in your configuration by placing a checkmark next to the desired channels. The labeling on each pair of differential leads indicates the corresponding input channel.



Selecting Input Resolution:
Select the input channel resolution for your configuration. Note that the sampling rate increases as the resolution decreases.

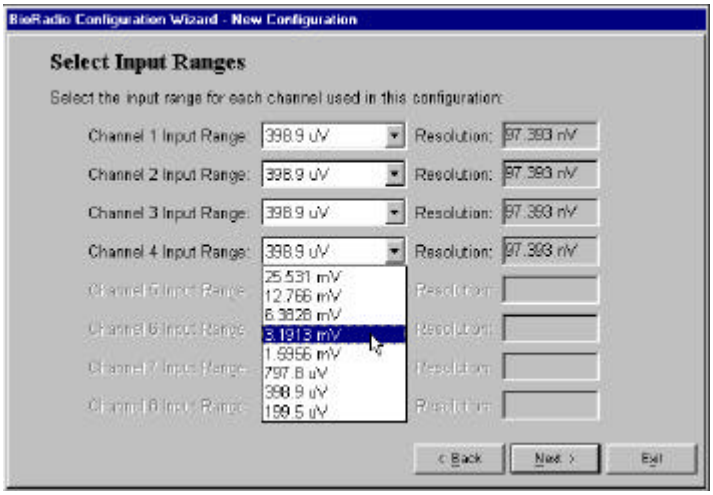


The table below lists all of the possible combinations of input channels and resolutions. The maximum input bandwidth (-3dB attenuation) is fixed at 0.262 times the sample rate.

Total Channels	Resolution: Low (8 Bits)	Medium (12 Bits)	High (16 Bits)
1	n/a	n/a	960 Hz
2	n/a	n/a	960 Hz
3	n/a	640 Hz	480 Hz
4	n/a	480 Hz	320 Hz
5	400 Hz	320 Hz	320 Hz
6	400 Hz	320 Hz	160 Hz
7	320 Hz	200 Hz	160 Hz
8	300 Hz	200 Hz	160 Hz

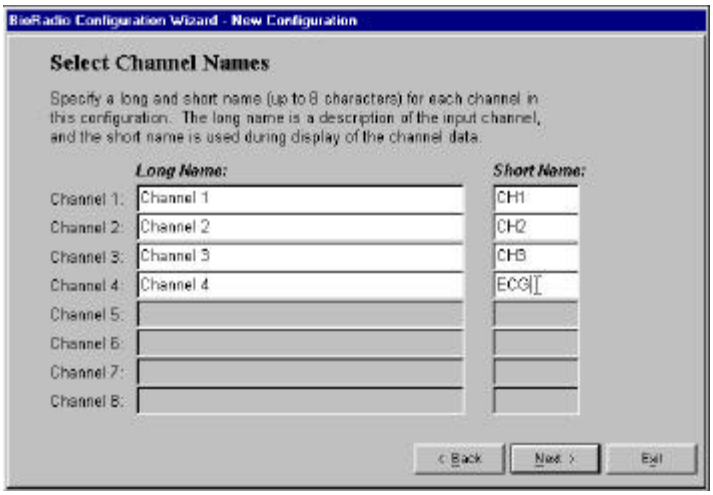
Selecting Input Ranges:

Specify the input range of the signal you wish to capture. Note you will achieve lower resolution as you increase the range. Make sure the selected input range matches the signal output of the corresponding sensor or electrode attached to the channel.

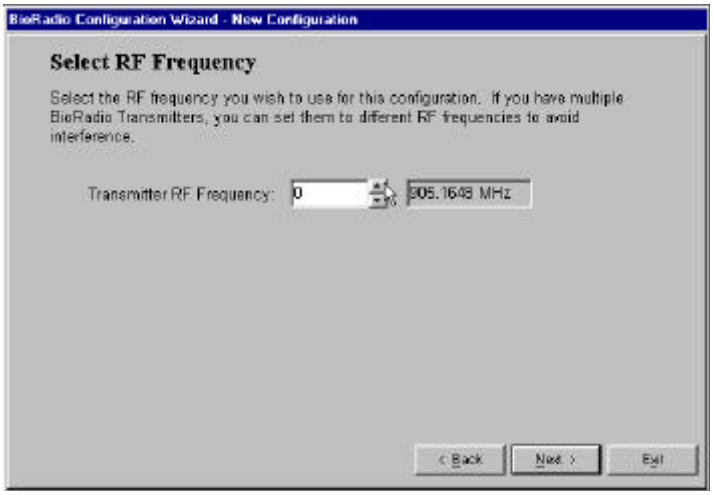


Selecting Channel Names:

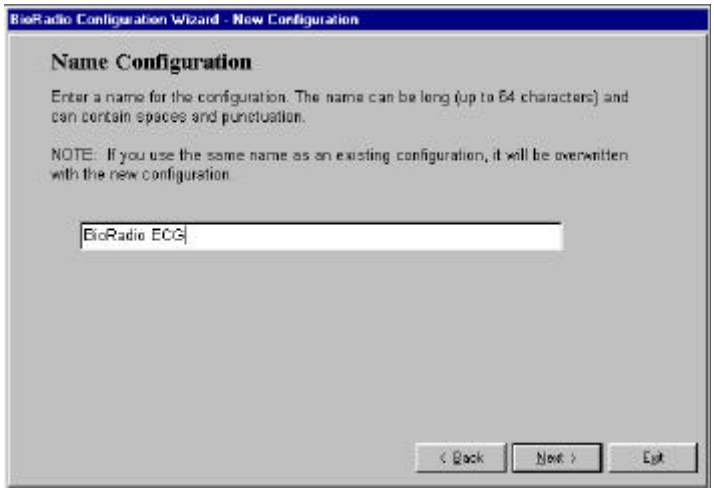
Enter Channel Names to provide a description of the corresponding channel lead (e.g. lead location, lead color, signal represented, etc.). The **Short Name** will later appear in the **Display Graph** next to each channel selected.



Setting the RF Frequency:



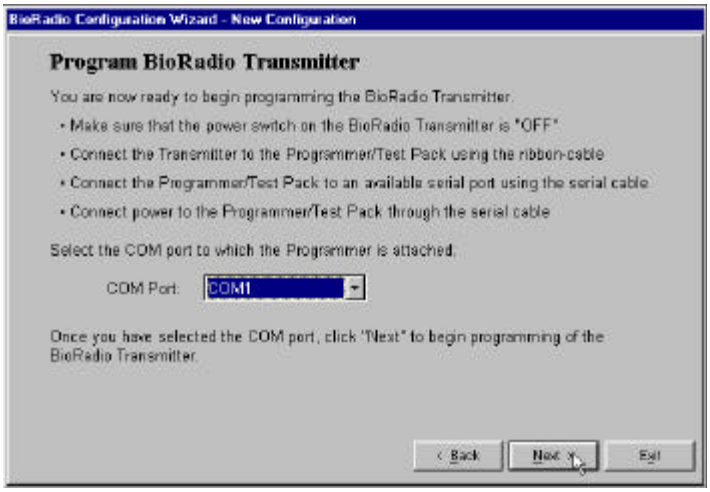
Naming the Configuration:
Name your custom configuration to be saved and used multiple times.



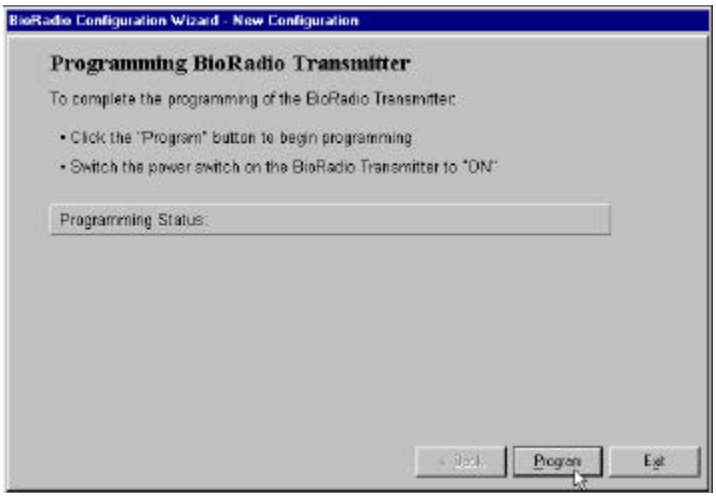
The Wizard will prompt you if you try to use an existing configuration name.

Programming the Transmitter:

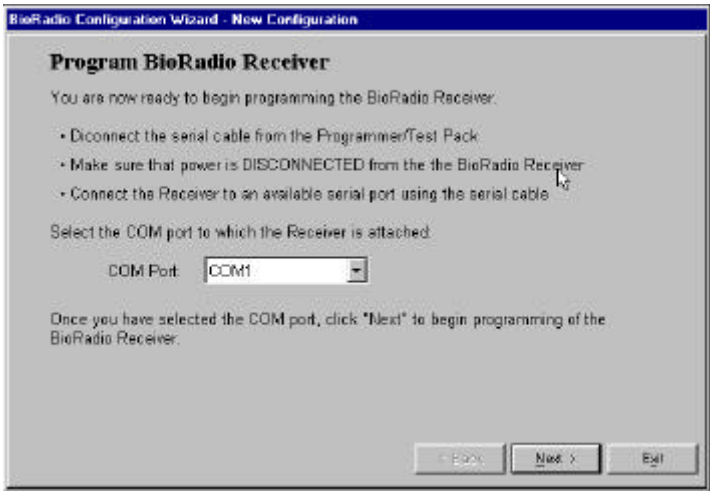
It is important to follow all steps in the correct order. You may have to unplug the Receiver if it is occupying the available serial port. (*Optional:* If you are using a laptop computer, powered only by battery, you may use the power switch on the Programmer/ Test Pack instead of plugging the AC power or battery adaptor in. The Programmer/Test Pack is turned ON by flipping the ON/OFF switch towards the red dot.)



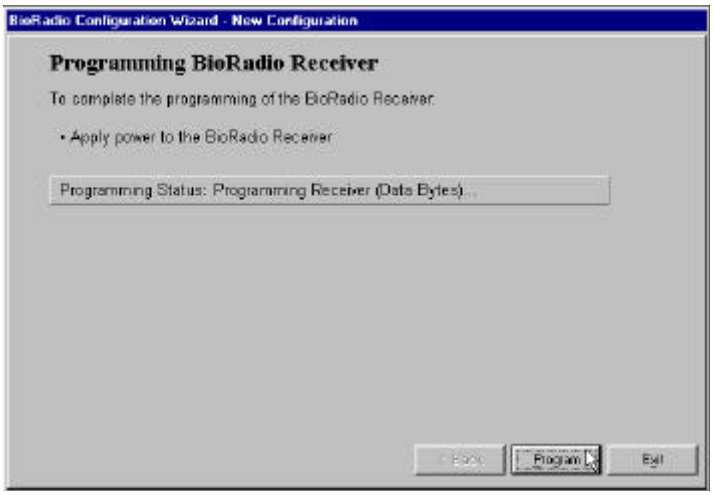
After clicking Next, the following screen instructs you to Click **Program** to begin detection of the Transmitter, then switch the Transmitter power ON.



Programming the Receiver:
Before programming the Transmitter, check to make sure the power is switched to OFF on the Transmitter. It is important to follow all steps in the correct order.

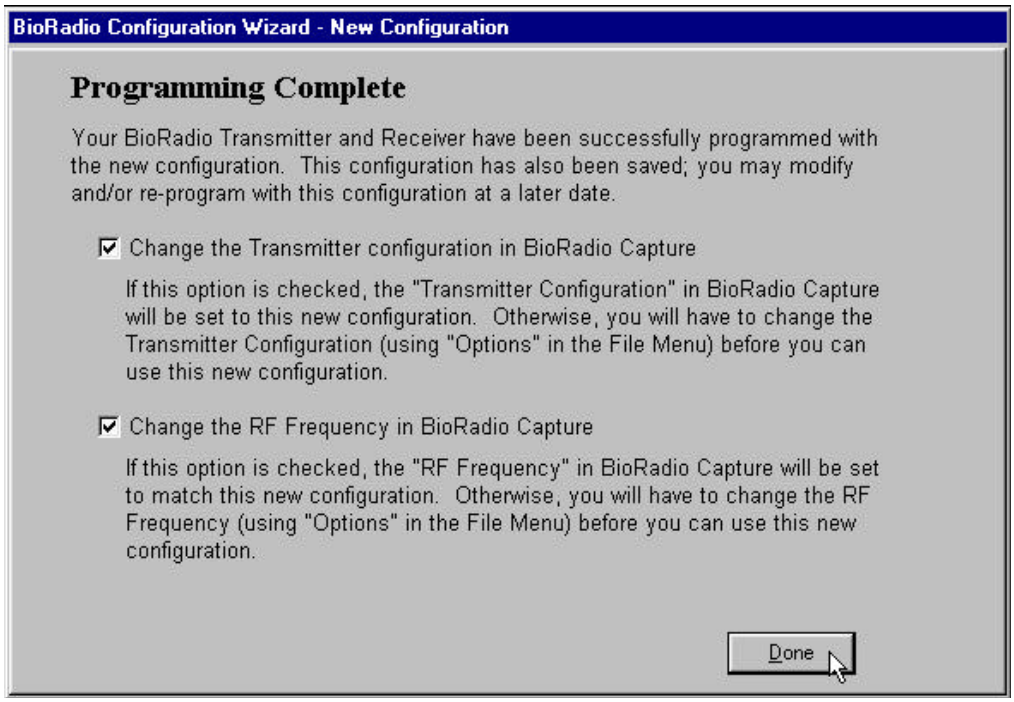


The screen below appears after clicking Next. Simply apply power to the serial port cable and click Program. If properly set-up the Wizard programs the Receiver to match the Transmitter and provides you with the programming status.



Programming Complete

The Configuration Wizard indicates the programming is finished and conveniently changes the BioRadio Capture program '**Options**' settings, in the **File** menu to reflect the recent changes in the BioRadio hardware configuration and frequency. Remove the checkmarks if you do not want the new Transmitter configuration or RF frequency settings to appear in the BioRadio Capture program.



Chapter 4: Viewing, Printing & Exporting Data

Starting View Mode

BioRadio Capture provides the ability to view stored multi-channel physiological data from a BioRadio Data (.bd) file.

To begin viewing a stored data file, start View Mode by:

- Clicking the **View Mode** button on the Toolbar, or
- Selecting **View Mode** from the **File** menu.

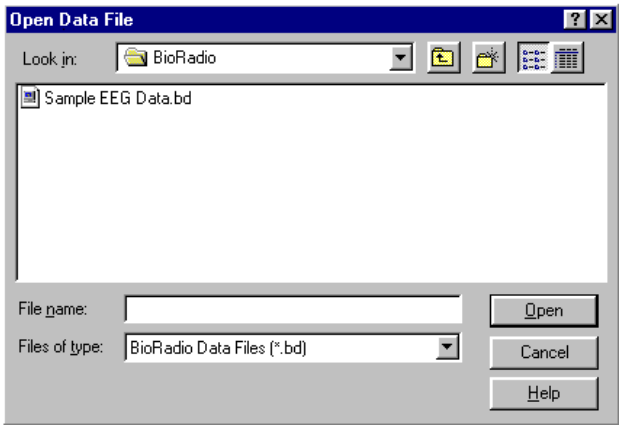
Once you have started View Mode, you can begin viewing stored data.

Viewing Saved Files

Once in View Mode, you can open a stored data file for viewing by:

- Clicking the **Open data file** button on the Toolbar, or
- Selecting **Open Data File...** from the **File** menu.

This displays the **Open Data File** dialog window, where you can select a BioRadio Data (.bd) file to display. When you open the data file, the Display Graph shows the data at the beginning of the file.



Changing the Display

Viewing saved data is similar to viewing the data in Capture Mode. All of the display features and commands can be customized in the same way. *Refer to* ***Chapter 3, 'Recording Physiological Data'*** *or* ***Chapter 5, 'BioRadio Command Reference'.***

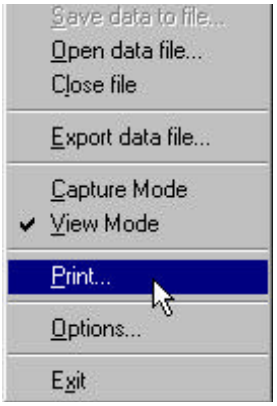
Searching through Data

When BioRadio Capture is in View Mode, a scroll bar appears at the bottom of the Display Graph. This scroll bar represents the entire length of the data file, and the scrollbar button represents the current view position of the data file.

You can click and drag on the scrollbar thumb to quickly move within the recorded data file and search for particular epochs of data. When you move the thumb, a window pops up indicating the file position (in hours, minutes, seconds, and hundredths of seconds). Once you release the thumb, the view location will update to the position you have selected. To view a continuous stream of data, click and hold either the forward or backward arrows.

Printing Data

In View Mode, you can print the currently displayed (screen view only) physiological data to any Windows printer. The printed output is time/date stamped including the timescale and sampling frequency of the data segment printed.



Click **Print** from the **File** menu

The grid will be printed unless it is hidden in the Display Graph.

Exporting Data

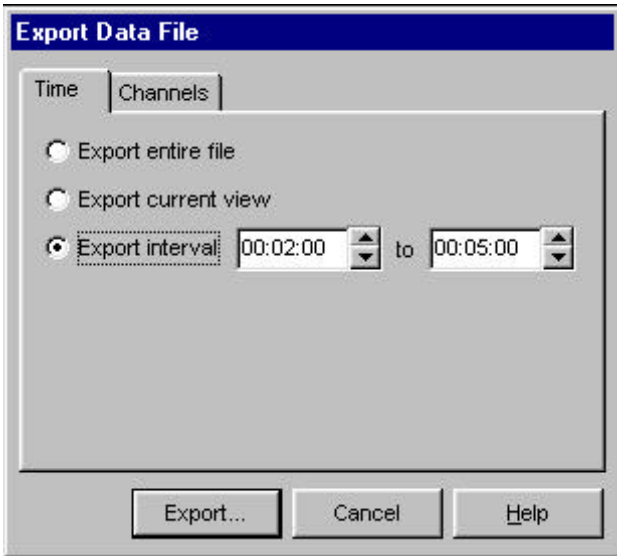
Exporting data translates a file to a non-BioRadio Data format that other programs can import. The data can be exported to ASCII data in column format. In View Mode, you can export all or part of the current data file to a space-delimited ASCII data file, which can be read by programs such as Microsoft Excel, Matlab®, etc. You can select any of the physiological channels to be exported to the ASCII data file, so that only data of interest is exported. This flexibility greatly reduces unnecessary time spent analyzing irrelevant data and saves file space. Therefore, you can export a BioRadio Data file in ASCII format, and open it in Matlab or Excel and perform complex numeric computation and data visualization using those programs' tools on a particular segment of data.

Note that only the raw data (as acquired by the Transmitter) is exported. Any viewing options (such viewing range, filters, etc.) are not reflected in the exported data file.

Begin exporting a file by:

Selecting **Export data file** from the **File** menu.

The **Export Data File** dialog window opens allowing you to select the time interval and channels which will be exported to an ASCII data file from the saved physiological data you are currently viewing. The Export Data dialog window contains two panes, **Time** and **Channels**.



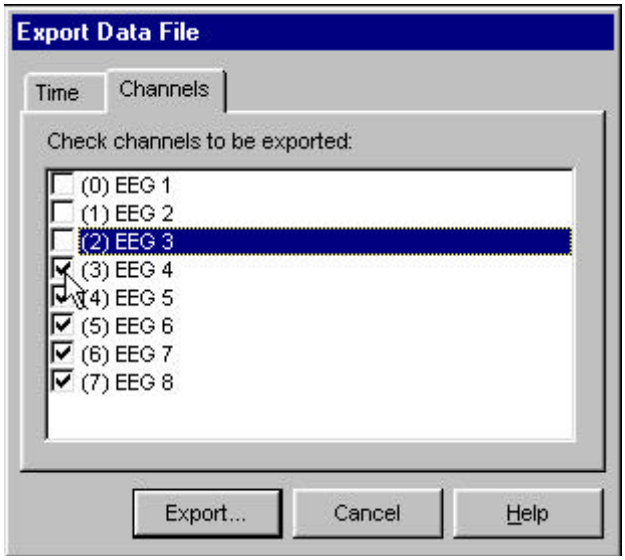
In the **Time** panel, you select the interval of time which will be exported to the ASCII data file:

Export entire file: Exports the entire duration of the BioData file.

Export current view: Exports only the duration of the BioData file which is visible in the Display Graph, based upon the settings for Timescale and the starting position.

Export interval: Exports the duration of the BioData file as set by the start and end input boxes, in hours, minutes, and seconds (HH:MM:SS). You can use the up/down arrows to change the start and end values, or you can type the times into the input boxes.

In the **Channels** panel, you can select which of the input channels will be exported to the ASCII data file. Only channels with a check mark will be written to the ASCII data file. The channels will be written in the order they are displayed in this list.



Once you have selected the time interval and channels to be exported, click the **Export...** button to begin exporting the data file. You will then see the Export File dialog window, where you enter a filename for the ASCII data file. Once you click **Save**, a progress dialog will appear displaying the export progress. Note that, for long BioData files, this may take several seconds to complete.

Chapter 5: BioRadio Command Reference

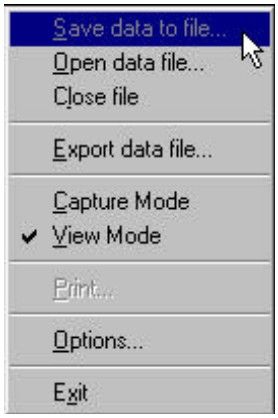
This chapter provides a brief summary of the commands in BioRadio Capture.

File Menu

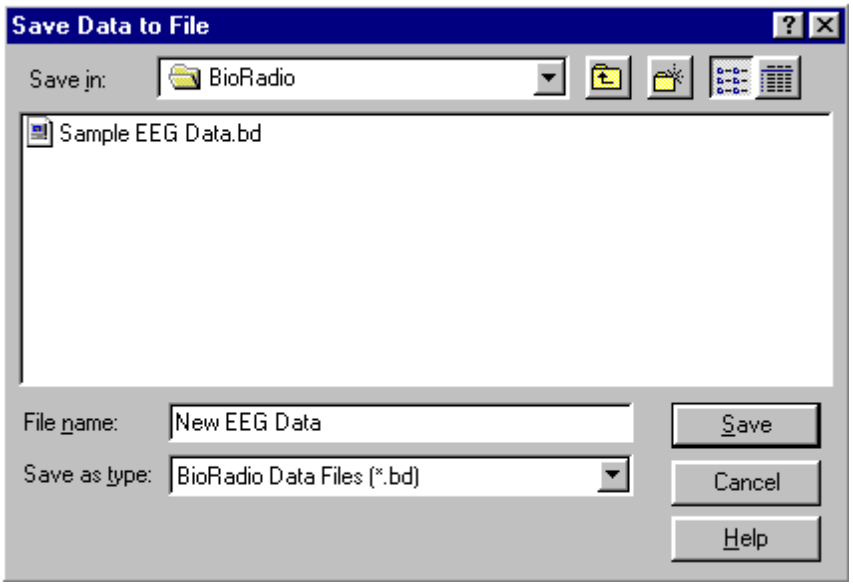
Save Data to file...

Save your data to a file by:

- Clicking the **Save data to file** hotkey button, or
- Opening the **File** menu and Clicking **Save data to file…**, or
- Keyboard Strokes: "**Alt+F",** then **"S".**



The window below opens allowing you to specify a name, format and a directory where the data will be saved.



Open Data File…

Open a saved file by:

- Clicking the **Open data file** hotkey button, or
- Opening the **File** menu and Clicking **Open data file…**, or
- Keyboard Strokes**: "Alt+F",** then **"O".**

Close File

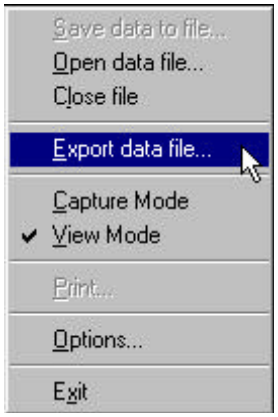
Close your data file by:

- Clicking the **Close file** hotkey button, or
- Opening the **File** menu and Clicking **Close file…**, or
- Keyboard Strokes: **"Alt+F",** then **"L".**

Export Data File…

Export your data to a different file format by:

- Opening the **File** menu and Clicking **Export data file…**, or
- Keyboard Strokes: **"Alt+F",** then **"E".**



Capture Mode

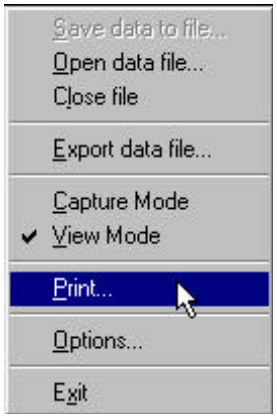
Begin capturing data by:

- Clicking the **Capture mode** hotkey button, or
- Opening the **File** menu and Clicking **Capture Mode**, or
- Keyboard Strokes: **"Alt+F",** then **"C".**

View Mode

View a saved file by:

- Clicking the **View mode** hotkey button, or
- Opening the **File** menu and Clicking **View Mode**, or
- Keyboard Strokes: **"Alt+F",** then **"S"**.



Print…

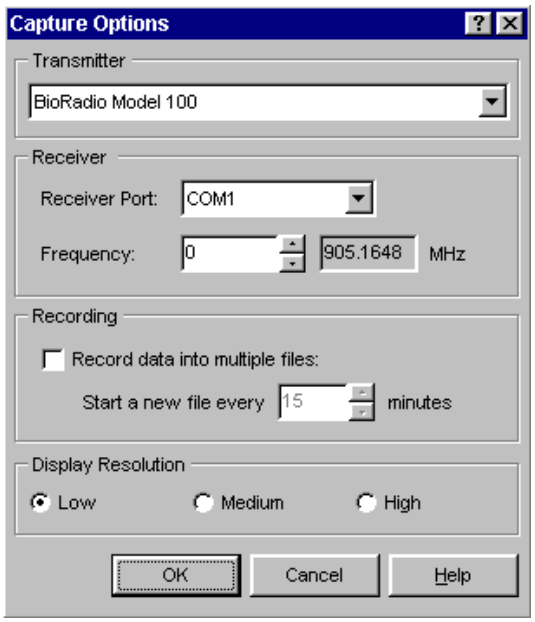
Print your data by:

- Opening the **File** menu and Clicking **Print…**, or
- Keyboard Strokes: **"Alt+F",** then **"P"**.

Capture Options

The **Capture Options** dialog allows you to configure how BioRadio acquires and displays data. Access the Capture Options dialog by:

- Opening the **File** menu and Clicking **Options…**, or
- Keyboard Strokes: **"Alt+F",** then **"O"**.



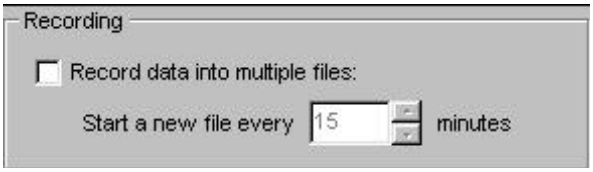
Transmitter: Allows you to specify the configuration of the BioRadio Transmitter. A custom configuration can be created using the BioRadio Configuration Wizard.

Receiver Port: Allows you to specify the COM port to which the BioRadio Receiver is attached. The default is COM1, but you can change this if you have the Receiver attached to a different port.

Frequency:

Allows you to set the RF frequency for the BioRadio Receiver during Capture Mode. You can click on the up/down arrows to set the frequency number (and the corresponding RF frequency, in MHz, is displayed). This setting MUST match the setting of the BioRadio Transmitter; refer to the documentation packaged with your BioRadio Transmitter for the proper setting.

Record data into multiple files:



Allows you to configure BioRadio Capture to split the recorded data into multiple files. The file name you specify in the Save Data dialog is appended with a four-digit sequence number (0001, 0002, etc.), and the sequence number increments as each file is written. You specify the maximum duration of each file (in minutes) in the **Start a new file every** entry box. Placing a checkmark in the Recording dialog box will record data into multiple files with the option of adjusting the time length of the files to range from 1 to 100 minutes in length. BioRadio records a file size of approximately 26 KB/min/channel.

Display Resolution:

Specifies the resolution for displaying real-time data. The default setting is **Low**, which causes BioRadio Capture to display the data at a coarser resolution, but at a faster update rate. If your computer is higher performance, you can set this to **Medium** or **High**. However, if the data appears "choppy" in real-time, you should set this to **Low**.

Exit BioRadio

Clicking on the **X** in the upper right corner of the screen**,** or

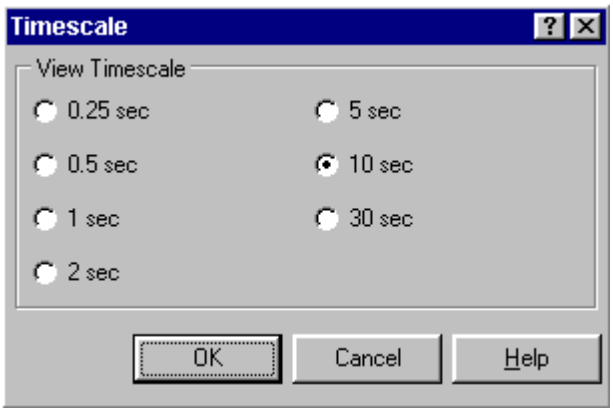
Opening the **File** menu and Clicking **Exit**, or

View Menu

Timescale

Adjust the viewing width (timescale) by:

- Clicking on the **Increase/Decrease Timescale** buttons to adjust the X-axis in predefined increments shown in the window below, or
- Opening the **View** Menu and clicking on **Timescale**, or
- Keystrokes: **"Alt+V"** then **"T".**



The Timescale dialog allows you to set the timescale (view width) of the Display Graph. This setting applies both to Capture Mode and to View Mode. You can select a timescale from the View Timescale buttons to specify the width of the Display Graph. The data can be viewed in epochs of varying durations which depend upon the number of input channels selected during configuration of the BioRadio.

The timescale with the sampling frequency (sampling frequency depends on number of input channels and resolution) can always be seen on the **Status Bar** window, located at the bottom of the screen.

Note that longer timescale settings will cause slower (more "sluggish") updates while viewing real-time data in Capture Mode. If the real-time display of data appears "choppy", you should select a shorter timescale, or set the **Display Resolution** to Low in the **Options** dialog.

Channels

Access the Channels configuration window by:

- Clicking the **Channel Setup** button on the Toolbar, or
- Selecting **Channels** from the **View** menu, or
- Keyboard strokes: "**Alt+V"** then **"C"**.

Filters

Open the filters configuration window by:

- Clicking the **Filter setup** button on the Toolbar, or
- Opening the **View** menu, clicking **Filters**, or
- Keyboard strokes: "**Alt+V"** then **"F"**.

Grid

Show or Hide the Grid from the Display Graph by:

- Clicking the **Show/Hide Grid** button on the Toolbar, or
- Placing a checkmark next to **Grid** on the **View** menu, or
- Using Keyboard Strokes: "**Alt+V",** then **"G"**.

Lock Scales

Lock the Scales on the Scale Control:

- Clicking the **Lock/Unlock Scale Controls** button on the Toolbar, or
- Placing a checkmark next to **Lock Scales** on the **View** menu, or
- Using Keyboard Strokes: "**Alt+V",** then **"K"**.

Toolbar

Show or Hide the Toolbar by:

- Removing the checkmark next to the **Toolbar** under the **View** menu, or
- Using Keyboard Strokes: "**Alt+V",** then **"O"**.

Scale Control

Show or Hide the Scale Controls by:

- Removing the checkmark next to the **Scale Control** under the **View** menu, or
- Using Keyboard Strokes: "**Alt+V",** then **"S"**.

Status Bar

Show or Hide the Status Bar by:

- Removing the checkmark next to the **Status Bar** under the **View** menu, or
- Using Keyboard Strokes: "**Alt+V",** then **"A"**.

Help Menu

- Click the Help button on the Toolbar, or
- Select **Help** from the **Menu Bar**.

Contents

Displays the table of contents for the online help file.

Index

Displays the index for the online help file.

Product Support

Displays options for Getting Help with BioRadio.

About BioRadio…

Displays the **About** dialog, which contains technical information such as the program version and the device identifier. You should record this information when requesting product support.

Getting Help with BioRadio

If you experience a problem using your BioRadio, please follow the steps below:

1. Check all cable connections and power supplies (batteries, AC adapter, etc.) Refer to your User Manual for reference in setting up the BioRadio hardware.

2. Refer to the Troubleshooting guide in the User Manual or in the online help. This will assist you with many common problems.

3. If you still cannot resolve the problem, contact Cleveland Medical Devices customer support. The preferred method of support is through e-mail, as this will allow us to properly address all customer concerns. Please prepare a description of the problem, along with the computer system you are using. You should also retrieve the software version information and device serial code as displayed in the **About** dialog (in the Help menu). E-mail this information to Technical Support at: support@clevemed.com.

4. In urgent cases, or if you do not have access to E-mail, you may contact Technical Support during regular business hours (9AM - 6PM EST) toll-free at 1-877-CLEVEMED (1-877-253-8363).

Chapter 6: Troubleshooting & Frequently Asked Questions

If your BioRadio is not performing properly, use this troubleshooting chart for quick solutions to common problems. If the problem persists, call Cleveland Medical Devices

Problem...	Possible Cause...	Remedy...
No data is displayed	Receiver Power cord or battery	Connect power cord or battery
	Transmitter power switch off?	Turn on power.
	Faulty power outlet?	Try another power outlet.
	Receiver cable is not connected properly to PC?	Connect Receiver cable to RS232 port properly. Check
	Transmitter is not connected	Connect transmitter properly.
	Transmitter batteries are dead. Receiver battery is dead.	Replace batteries making sure the poles are in the proper
Signal image breaks up	Dropped packets?	Bring the Receiver and Transmitter closer together. Try not to block the transmission path with the subject. Move large metal
Signal image is cut-	Amplitude of Data outside visible	Adjust Scale Control.
Signals are hard to visualize	The channel color selected does not contrast well with the	Change channel color.
Computer freezes up or display graph	PC needs a faster processor	Run BioRadio Capture on a Pentium™ 200/MMX or

When starting Capture Mode, an error message is displayed stating that the selected COM port is in use.

Possible cause: Another application is using the specified COM port.
Solution: Close the other application, or use a different COM port. (See Capture Options).

Possible cause: Your computer does not support the specified COM port.
Solution: Use a different COM port. (See Capture Options).

When starting Capture Mode, an error message is displayed stating that no BioRadio Receiver could be found on the specified COM port.

Possible cause: The Receiver cable is attached to the wrong COM port.
Solution: Attach the Receiver cable to the correct COM port.

Possible cause: BioRadio Capture is configured to use the wrong COM port.
Solution: Configure BioRadio Capture to use the correct COM port. (See Capture Options).

Possible cause: Power is not applied to the Receiver.
Solution: Check that the power cable or battery is properly connected to the Receiver and that your power source works.

After starting Capture Mode, the status bar shows less than 100% packets received.

Possible cause: The Transmitter is out of range.
Solution: Keep the Transmitter within range of the Receiver (within 25 feet indoors, or up to 100 feet line-of-sight).

Possible cause: The Transmitter batteries are weak.
Solution: Replace the Transmitter batteries (new AAA batteries should last approximately 10-12 hours).

After starting Capture Mode, no data is seen in the Display Graph, and the status bar shows 0% packets received.

Possible cause: The Transmitter is not turned on.
Solution: Turn the power switch on the Transmitter to the "On" position.

Possible cause: The Transmitter batteries are dead.
Solution: Replace the Transmitter batteries.

Possible cause: The Transmitter and Receiver are set to different RF frequencies.
Solution: Call the Toll-free Customer Service Number to request an RMA number and return the device so that the frequency can be reprogrammed.

The channel signal does not appear in the Display Graph.

Possible cause: The signal is outside the viewing scale.
Solution: Adjust the channel's Scale Control until the signal is visible.

Possible cause: The selected channel color does not contrast well with the graph background.
Solution: Change the channel's display color. (See Channels Dialog).

The Display Graph appears "choppy" or sluggish while displaying data in Capture Mode.

Possible cause: The computer is too slow to display the graph data.
Solution: Run BioRadio Capture on a Pentium™ 200/MMX or faster computer.

Possible cause: The Timescale is too large to display the requested number of data points.
Solution: Change the timescale to a smaller value. (See Timescale Dialog).

Possible cause: The Display Resolution is configured too high for the computer.

BioRadio Model 110 Specifications

State-of-the-Art System for Recording Physiological Signals

System Specifications	
Carrying Case Dimensions	14.0" high x 17.0" wide x 5.0" deep
Weight (all parts & accessories)	6 lbs
Data Transmission Range	~100 feet, line of sight (~25 feet through two indoor walls)
Operating Conditions	Humidity: 5% to 90% (non-condensing) Temperature: 50-85 °F

Receiver	
Dimensions	3.5" x 2.0" x 1.0" (not including antenna)
Weight	2.7 oz
Antenna	3.0" flexible
Power Supply	2 pin AC/DC adaptor plug, 6' cord length -or- 9 V alkaline battery
Power Consumption	56 mA @ 9.0 V
Cable interface	9-pin jack connects directly to PC's RS232 port via serial cable
Case Material	ABS

Transmitter	
Dimensions	4.0" x 2.2" x 0.7" (not including antenna)
Weight	3.4 oz with batteries
Antenna	3.0" flexible
Input Range	±399 µV
Resolution	Fixed 195nV (12 bits)
Noise	< 1 µV peak-to-peak
Sampling Rate	200 S/s per channel
Actual Usable Dynamic Range	70 dB
Transmitter RF Band	902-928 MHz (ISM band)
Transmitter Power	≈1 mW
Power Source	2 AAA alkaline batteries (approx. 10-12 hour lifetime)
Power Consumption	~26 mA @ 3.6V
Input Interface	26-pin male jack connects to Electrode Cable or Test Pack
Input Impedance	$1.0 \times 10^9\ \Omega$
Filter Input Bandwidth	0.33 Hz - 52 Hz (-3dB attenuation)
User Control	ON/OFF switch
Case Material	ABS with Mounting Clip

BioRadio Model 110 Specifications cont.

Test Pack	
Dimensions	4.0" x 2.5" x 1.0"
Weight	2.4 oz
Cable interface	5.5" 26-pin cable connector to Transmitter
Signal Output	300 µV, peak-to-peak @ 12 Hz (nominal)

Cables	
Receiver Cable	3' 9 pin
Electrode Cable	8 channels, 2 references: 9 mm gold electrode cups
Extender Cable	6' Standard M/F 9 pin
Receiver 9V Battery Cable	6"

Software	
Compatibility	Personal computer with Pentium/MMX 200 MHz or higher processor (or equivalent);
Estimated Recorded File Size per Minute	~210 KB/min

Accessories	
Mounting Band	36" long adjustable velcro closure
Screwdriver	Philips
Electrode Cream	Highly conductive, electrolytes and preservatives in non-ionic, hypo-allergenic base, buffered to skin pH

Preliminary specifications, subject to change

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. Thee limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications not expressly approved by Cleveland Medical Devices Inc. could void the user's authority to operate the equipment.

Trademark Acknowledgments

BioRadio is a trademark of Cleveland Medical Devices Inc., Cleveland, Ohio.

Windows and MS Excel are trademarks of the Microsoft Corporation.

Matlab is a trademark of The Math Works Inc.

All other products or brand names are trademarks or registered trademarks of their respective companies.

Software License Agreement

Copyright ©1998 Cleveland Medical Devices Inc. All rights reserved.

IMPORTANT - READ CAREFULLY THE FOLLOWING SOFTWARE LICENSE AGREEMENT ("LICENSE") BEFORE BREAKING THE SEAL ON THE SOFTWARE PACKAGE CONTAINING THE DISKETTES. BREAKING THE SEAL CONSTITUTES YOUR ACCEPTANCE OF THE TERMS AND CONDITIONS OF THIS LICENSE WITH RESPECT TO THE USE AND POSSESSION OF THE SOFTWARE CONTAINED THEREIN.

IF YOU DO NOT WISH TO BE BOUND BY THE TERMS AND CONDITIONS OF THIS LICENSE, PROMPTLY RETURN THE PACKAGE WITH THE SEAL INTACT ALONG WITH THE BIORADIO™ PRODUCT TO WHICH IT APPLIES.

Cleveland Medical Devices Inc. retains full ownership rights to the software program ("Program") and documentation and upon payment of the purchase price of the BioRadio product grants to Purchaser a nonexclusive license subject to the following conditions:

This Program may be used only with the BioRadio product to which it applies. The Purchaser may install the Program on only one computer; make one copy in machine readable form solely for backup purposes, provided that you reproduce all proprietary notices on the copy; and physically transfer the Program from one computer to another provided that the Program is used only on one computer at a time. The Purchaser may not copy, distribute, rent, lease, sub-license, transfer, or use the Program except as allowed herein. In addition, the Purchaser may not alter, modify, decompile, translate, disassemble the Program; or use it to create a derivative work.

Purchaser's right to use this Program automatically terminates upon failure to comply with any provision of this License or upon your destruction of all copies of the Program and documentation.

If Purchaser purchased an upgrade version of the Program, either separately or with a BioRadio product purchase, it constitutes a single product with the Program that you upgraded.

This License is deemed made, accepted and delivered in the State of Ohio and shall be construed, interpreted and governed by the laws of the State of Ohio, without regard or effect given to its or any other jurisdiction's conflicts of laws jurisprudence.

Software Limited Warranty

Cleveland Medical Devices Inc. warrants for a period of 90 days from the date of delivery to Purchaser that the Program diskettes will be free from defects in material and workmanship under normal use. In the event Purchaser within the warranty period notifies Cleveland Medical Devices Inc. of defects in material or workmanship, Cleveland Medical Devices Inc. exclusive remedy will be to replace the defective diskettes.

CLEVELAND MEDICAL DEVICES SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO DEFECTS IN THE DISKETTES AND THE PROGRAM. IN NO EVENT SHALL CLEVELAND MEDICAL DEVICES INC. BE LIABLE FOR ANY LOSS PROFIT OR ANY OTHER COMMERCIAL DAMAGE, INCLUDING, BUT NOT LIMITED TO, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES EVEN IF CLEVELAND MEDICAL DEVICES INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states/jurisdictions do not allow limitations on the duration of an implied warranty, so the above limitation may not apply to you.

To return Program diskettes to CLEVELAND MEDICAL DEVICES under a warranty claim, the Purchaser must first contact CLEVELAND MEDICAL DEVICES' Customer Support at **216-791-6720** and receive a Return Merchandise Authorization (RMA) number. Purchaser must place the RMA number on the outside of the package containing the diskettes being returned and ship the package to CLEVELAND MEDICAL DEVICES' facility, freight prepaid. Any returned diskettes received by CLEVELAND MEDICAL DEVICES without an RMA number shall be sent back to the Purchaser.

Product Limited Warranty

CLEVELAND MEDICAL DEVICES warrants the BioRadio products to be free from defects in material and workmanship under normal use and service for a period of 90 days from the date of delivery. The obligation of CLEVELAND MEDICAL DEVICES under this warranty is limited to the repair, re-work or replacement, at CLEVELAND MEDICAL DEVICES' option, of any BioRadio product which within 90 days from date of delivery is examined by CLEVELAND MEDICAL DEVICES and discloses to CLEVELAND MEDICAL DEVICES' satisfaction to have been defective.

For this warranty to be available to Purchaser, CLEVELAND MEDICAL DEVICES within 14 days of purchase must have received from Purchaser a completed warranty card.

CLEVELAND MEDICAL DEVICES will not be responsible for, and the warranty shall not apply to, any damage caused by the following: natural disasters, war, civil disturbances, abuse, misuse, negligence, usage of incorrect electrical supply voltage, usage not in accordance with the operation instruction manual, or normal wear and tear.

This warranty shall not apply to any BioRadio product which has been repaired, serviced, disassembled or modified by any party other than CLEVLAND MEDICAL DEVICES or if the warranty card has been tampered with. No warranty claim will be allowed for BioRadio products damaged by improper use, operation or handling after delivery of the BioRadio product. Purchaser must file all claims resulting from damage in transit with the carrier or carrier's agent. Expenses incurred in connection with claims for which CLEVELAND MEDICAL DEVICES is not liable may be charged to the Purchaser.

Upon submission of a warranty claim, Purchaser is deemed to have waived any and all other claims against CLEVELAND MEDICAL DEVICES. CLEVELAND MEDICAL DEVICES shall in no event be liable to PURCHASER or to Purchaser's customers for any incidental or consequential damages, loss of use or other commercial loss, however occasioned.

CLEVELAND MEDICAL DEVICES MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR PERFORMANCE CHARACTERISTICS, EXCEPT TO THE EXTENT SET FORTH HEREIN.

Returns

To return a BioRadio product to CLEVELAND MEDICAL DEVICES under a warranty claim, the Purchaser must first contact CLEVELAND MEDICAL DEVICES' Customer Support at **216-791-6720** or toll-free at **877-CLEVEMED** and receive a Return Merchandise Authorization (RMA) number. Purchaser must place the RMA number on the outside of the package containing the BioRadio product being returned and ship the package to CLEVELAND MEDICAL DEVICES' facility, freight prepaid. Any returned BioRadio product package received by CLEVELAND MEDICAL DEVICES without an RMA number shall be sent back to the Purchaser.

Cleveland Medical Devices Inc. Customer Support

If you have any questions regarding this product, please first refer to this User's Manual and on-line help files located within the program. To obtain warranty service, you must call Cleveland Medical Devices and speak with a Customer Service Representative. Be prepared to provide (1) your name, address, telephone number; (2) the BioRadio model and serial number; and (3) an explanation of the problem.

Telephone:	**(216) 791-6720 or Toll-free 1-877-CLEVEMED** 9:00 a.m. - 5:00 p.m. EST Monday - Friday
Fax:	(216) 791-6739
E-Mail:	support@clevemed.com
Web:	http://www.clevemed.com
Mailing Address:	**Cleveland Medical Devices Inc.** **11000 Cedar Avenue, Suite 130** **Cleveland, Ohio 44106**

WARRANTY INFORMATION

(Retain this information for your records)

Cleveland Medical Devices Inc. thanks you for your recent product purchase. For your benefit, we recommend that you record the pertinent details below. If necessary, this information will allow us to better serve your needs. We highly recommend that you staple a copy of the sales receipt to this page of the manual.

Model Description: _____

Serial Number: _____

Date of Purchase: _____

GLOSSARY

ASCII (American Standard Code for Information Inter-exchange)
A standard character set and coding scheme used to represent letters, numbers, symbols, and control characters.

Analog
A continuous sound wave or signal, such as a voice, that conventional telephone lines were developed for.

Bandwidth
The required capacity for the data volume and transmission rate.

Baud Rate
The number of signal elements per second occurring on a communications channel. Since a signal element can represent more than one bit, baud rate is not necessarily the same as bits per second.

BPS
The number of bits that are transmitted in one second. This is the basic unit of measure for serial data transmission.

Digital
A non-continuous signal, voltages representing either an on or off condition used to represent 1 data bit.

INDEX

A

ASCII files 20

B

BioData files 20

C

Capture mode 14, 26
Changing the display 15, 22
Channels
- filtering 17, 30
- viewing 16

Closing files 20, 26
Colors 16
COM port 12, 27
Configuration Wizard 14

D

Display graph 12
Display resolution 28, 35

E

Exporting 23, 24, 26

F

File menu 11, 25
Files
- closing 20, 26
- exporting 23
- multiple 28
- opening 21, 26
- printing 22
- saving 19

Filters 17, 30
- cutoffs 18

H

Help menu 31, 32

M

Menu bar 11

O

Opening a file 21, 26
Options 13, 27
Output file 12

P

Printing 22

R

RF frequency 13, 28
RF status 12

S

Sample rate 12
Saving data 19
Scale control 11, 15, 30
Scrollbar 22
Searching 22
Setting options 13
Status bar 12, 31
Support 32, 42

T

Timescale 15, 29
Toolbar 11, 30
Troubleshooting 33-35

V

View menu 29
View mode 21, 27
View scale 11, 15

Notes:

The information presented in this publication has been carefully checked for accuracy; however, no responsibility is assumed for inaccuracies, whereas, specification is subject to change without notice.

Part # 392-0000, rev 1