

FTI-1

AUDIOVISUAL FREQUENCY THERAPY AND DIAGNOSTICS INSTRUMENT WITH BÈKÈSY AUDIOMETER

Technical users manual v0.0

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Disclaimer

This instrument is intended for research use only!

It is not yet approved for clinical use on humans!

We (Life Cooperation AB and its employees) make no medical claims what so ever!

The instrument is not intended to treat, cure or diagnose any illness or medical condition.

We (Life Cooperation AB and its employees) cannot be held responsible for any injury or damage that might occur when using this instrument or as a direct or indirect result of having used the instrument.

You use this instrument entirely at you're own risk!

Thank you!

For choosing this instrument, the therapy instrument of the future.

It is probably one of the worlds most accurate frequency generating instruments.

It has three main parts:

It generates frequencys with an acuracy of 8 decimals.

It has a békésy type screening audiometer with optional frequency sweep. Requires a PC and software

It has an optional pulse oxymeter with logging capability.

A optional light module is under development.

About this manual

This manual is not intended to educate the user in any form of therapy or diagnostics techniques. It is a users manual on how to operate the instrument.

Getting started

Connect the handbox and any optional equipment to its rear connector.

See picture 2 on page 4.

Start the instrument by pressing the on button on the frontpanel. If it does not start, flip the main power switch on the rear panel. See picture 2 on page 4.

After a few seconds you should see the main menu.

Operating the instrument is done though a series of several menues, described later in this manual. You can allways return to the main meny by pressing the Esc key or (in most menus) to the previous menu with the 0 key.

Battery and charging

The instrument is battery operated and needs to be recharged at regular intervals.

At the lower right corner of the main menu you can see the battery voltage. With a fully charged battery it should read over 6.0v. If it drops below 5.2v the lowbatt led will be turned on to alert you. Below 5.0v the LCD backlight will automatically be turned off to save power. At 4.8v the instrument will shut down.

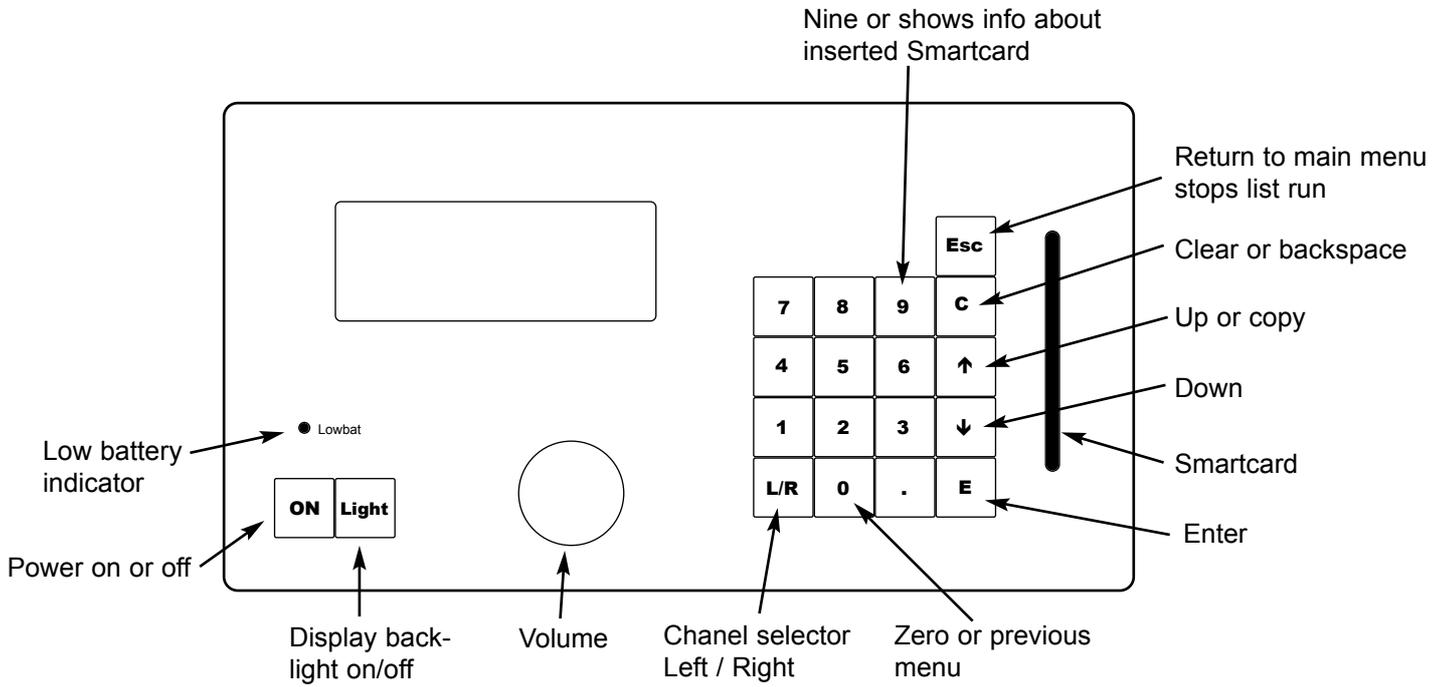
You may use the instrument while charging, but the quality of the output signal will decrees slightly. With a new battery, the instrument will run for over 8 hours and you will have more then one hour of use after the lowbat led is turned on. As the battery ages the runtime decrees, so you need to replace the battery after 2-5 years of use.

Quick start

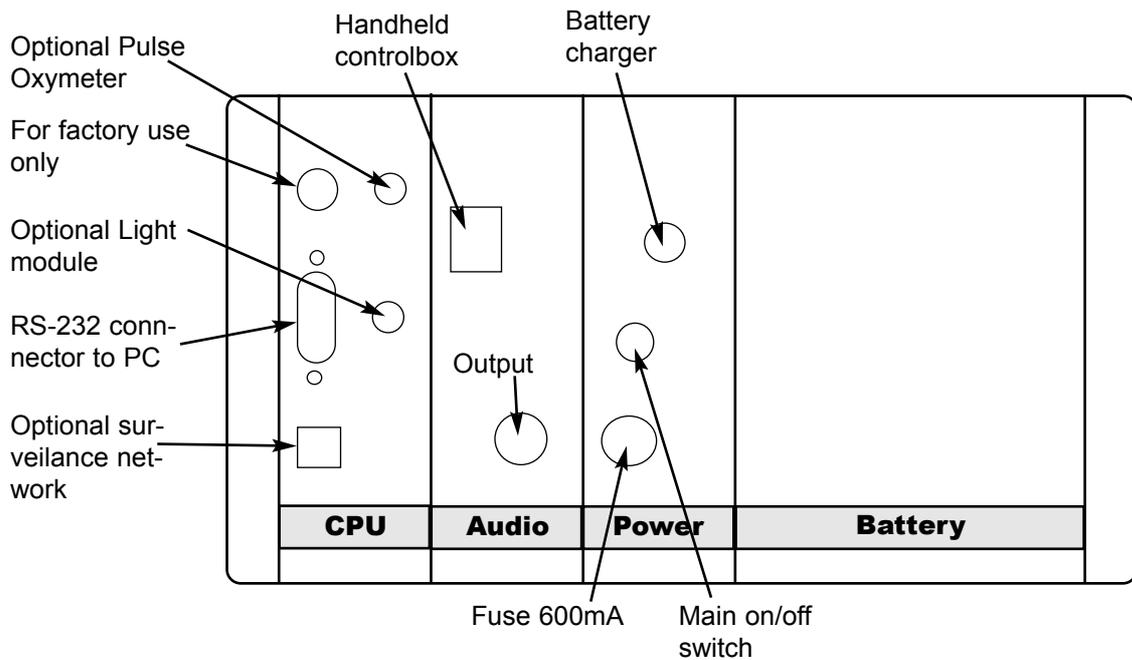
The instrument has several advanced features that are user changeable in the settings menus. For normal use, you usually do not have to change them. It is however, recommended that you read though this entire manual to get an understanding of what is possible to do.

The fastest way to get started generating output frequency's, is to read the section "Testing a frequency" and "Editing/Entering a frequency list"

To use the Audiometer, read the section "Audiometer" you need a PC with additional software to view the result of the test.



Picture 1, frontpanel



Picture 2, rearpanel

The menu hierarchy

1 - Frequency List
2 - Single frequency
3 - Di agnos
4 - Settings 6. 2v

This is the main menu. You can always return to this menu by pressing the Esc key. The value displayed in the down right corner is the battery voltage. When it gets below 5v the accuracy of the instrument will rapidly decrease.

1 - The Frequency list is the main therapeutic function of the instrument. It can store up to 64 frequencies in 16 positions. Each position has two channels, left and right, with its own settings for phase, volume, sweep time and time to run.

2 - The Single frequency mode is primarily used for testing how the patient receives a certain frequency.

3 - Diagnose menu takes you to the instruments Audiometer and Pulse oxymeter.

4 - The Settings menu contains all the user changeable options such as filter and default values.

1 - Run
2 - Edi t
3 - Vi ew/Del ete pos.
4 - More. . .

Pressing the 1 key in the Main menu takes you to the Frequency list menu.

1 - Run the list entered in Edit (2) or loaded from Smartcard.

2 - Edit the list in memory or enter a new list.

3 - The View/Delete pos. screen is used to delete list positions (frequency's) and it shows the patient's interactions as well as pulse and oxygen level at each frequency.

1 - Load SmartCard
2 - Save SmartCard
3 - Erase SmartCard
4 - Erase memory

For this menu, press the 4 key in the Frequency list menu.

1 - Load a Frequency list from Smartcard.

2 - Save a Frequency list to Smartcard.

3 - Erase Smartcard (see next menu).

4 - Erase Frequency list in memory.

1 - Li st data
2 - PO l og
3 - Whol e card
4 - Format!

Pressing the 3 key in the previous menu takes you to the Erase Smartcard menu.

1 - Erases the frequency list from the card.

2 - Erases the pulse oxygen log from the card.

3 - Erases the whole card.

4 - Formats the card. This may take more than 3 minutes!

Testing a frequency

```
Frequency i n Hz
■
Vol :      O2: --- P: ---
```

Pressing the 2 key in the Main menu takes you to the Single frequency testing.

The Single frequency mode is primarily used for testing how a patient receives a certain frequency.

```
Frequency i n Hz
■
Vol : 185 O2: 99 P: 65
16. 564875Hz
```

Enter the frequency to be tested, ex. 16.564875 and press enter. Adjust the volume with the volume knob or let the patient adjust with the + and - keys on the hand box.

You can observe what is happening with the patient's heart rate and SpO2 level and decide if the frequency is to be used. This requires that you have the optional pulse oximeter connected.

If you want to use the frequency, press the up arrow key to copy the frequency and it's volume to the first available position in the frequency list in memory. For a explanation on frequency lists, see the next chapter, "Editing / Entering a Frequency list".

Editing / Entering a Frequency list

■	L01
Ph: 000 Sw: Vo: 150	
Ti me: 2: 00 00: 00: 00	

Pressing the 2 key in the Frequency list menu takes you to the Edit / Enter screen. The cursor should be in the upper left corner waiting for you to enter a frequency. Enter 25 and press the E key (Enter). The cursor is now in the second frequency position which is used for frequency sweep. You may enter a frequency or skip it by pressing E.

25. 00000000	L01
0. 00000000	
Ph: 000■ Sw: Vo: 150	
Ti me: 2: 00 00: 00: 00	

The screen should now look like this (if you didn't enter a second frequency). The cursor at the phase position. Pressing any number key will toggle the phase between 0 and 180 deg. If you enter 180, the output frequency of the left channel will be 180 degree out of phase with regards to the right channel, regardless of the phase setting in the right channel.

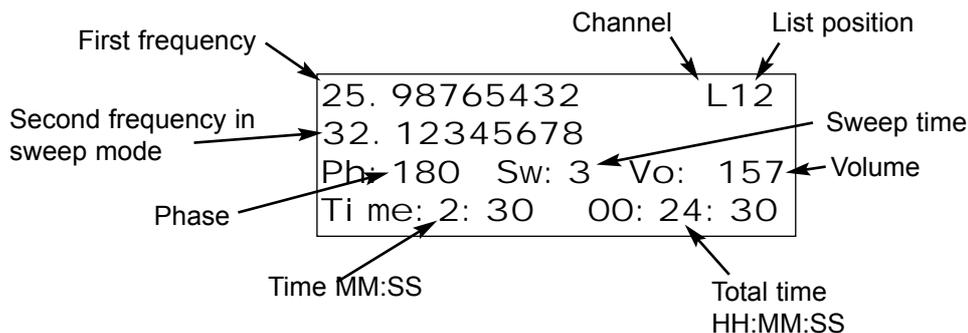
Press E and you will enter the frequency sweep time position. Enter a sweep time from 1 to 60 seconds. A frequency sweep will only work if you have a second frequency entered, if you skipped that, entering a sweep time will have no effect.

Press E again to the volume position. Enter a value between 0 and 192 or turn the volume knob. See Volume setup in the section Frequency list setup for default volume settings and automatic calculation of best volume.

Press E to enter the time position. The time entered in Default time setup is automatically filled in and you may change it by clearing with the C key or accept it by pressing the E key.

When leaving the Time position the next list position will be displayed. Shown in the upper right corner as L02.

You may browse between list positions with the arrow keys. Pressing the down arrow will return you to the previous frequency. Pressing the L/R key will toggle between left and right frequency. All the data you enter in the left frequency are automatically copied to the right frequency so you don't have to enter them twice. If you don't want the same frequency in both channels, you can press the L/R key and change the right channel.



Saving a Frequency list

```
1 - Load SmartCard
2 - Save SmartCard
3 - Erase SmartCard
4 - Erase memory
```

```
Card:
Enter number for new
card, max 12 char.
1234█
```

```
Card 1234
Created 030513
Last      030513 17: 01
Rem. PO l og 01: 25: 20
```

After you have finished entering the frequency's you intend to run through, you are recommended to store the frequency list on a Smartcard.

Press 4 (More...) in the frequency list menu to enter the Load/Save/Erase menu. Insert a new Smartcard and press 2 (Save Smartcard).

With a new card, you will be asked to enter a card number. Enter, for example, 1234 and press E. You can change the card number later from the Setup Smartcard menu, described later in this manual.

Press 9 to verify that the card has been written. You should see a screen like the one to the left. This screen is accessible from all non-input menus by pressing 9. It shows Card number, card creation date, the last date and time a frequency list was saved to the card and remaining log space for the pulse oxymeter in HH:MM:SS. The maximum log time depends on the log interval; default is every 10 seconds. You can change that in the Setup.

Running a Frequency list

Press 1 in the main menu to enter the Frequency list menu. Press 1 (Run), then press 1 or 2 to start the list.

The screen shown is the same as in Editing, see page 7. You can use the arrow key to move back or forth in the list and the L/R key to view the other channel.

The subject receiving the frequency's may change volume with the + and - keys on the hand box. The new volume will be saved to the list in memory. If you save the list to the subjects Smartcard after the completion of the list run, he/she will have the correct volume settings saved for the next time you run this list. This can be done automatically if you enable the Auto save setting (see settings later in this manual). If so leave the card in the slot for the entire run.

The subject can also log his/hers "feeling" of the frequency by pressing the G (good) or B (bad) keys on the hand box. Up to 255 key presses per list position will be logged. These will also be saved to the Smartcard if saving after the completion of the list run and overwrite key presses from any previous run.

After running a Frequency list

```
*****  
End frequency list  
*****  
Esc to continue
```

When the frequency list is finished, you should see a screen like the one to the left. If you have the optional surveillance monitor connected, it will alert you audio visually that the list has ended. Press Esc to go to the main menu.

If the auto save option is selected in Setup, all changes to volumes, good and bad key presses, Pulse and oxygen level (if you have the optional pulse oxymeter) are saved to the Smartcard (if one is inserted). These changes will be saved to the Smartcard in the slot regardless of if it is the current frequency list on the card or if it is another card.

Press 1 in the main menu to view the Frequency list menu and from there, press 3 to view the result of the frequency list.

```
Frequency list      L01  
16.564875          189  
SpO2: 98 Pulse: 56  
Good: 3 Bad: 0
```

In this view you can use the arrow and L/R keys to browse the list. The example to the left shows position 1 and the frequency of 16.564875Hz, volume 189, Oxygen (SpO2) 98, Pulse 56, 3 good key presses and no bad. This tells you that the subject might have received the frequency well since the oxygen level is ok and the pulse is relaxed and that he/she obviously liked it since there are 3 good keys and no bad. So keep this frequency for the next run and check the rest in the same way.

```
Frequency list      L07  
18.00834715        180  
SpO2: 98 Pulse: 68  
Good: 1 Bad: 12
```

This example shows the 7:th position. This frequency has obviously annoyed the subject since the pulse is higher and there are 12 bad keys. If you decide not to run this frequency again, press C to delete it.

The Audiometer

The instruments audiometer is a screening audiometer of Bekesy type. A modification invented by Georg von Békésy at his time as a guest of the Karolinska Institute in Sweden. He developed a new type of audiometer that is operated by the patient. Georg von Békésy is the Nobel Prize winner in Medicine 1961.

Principal

The instrument outputs a tone that is slowly increasing in volume. When the subject to be tested hears the tone he/she presses and holds a button and the volume will decrease as long as he/she holds it pressed. When he/she no longer hears it, he/she releases the button and the tone is once again increasing in volume. This pressing/releasing of the key is continued though out the entire test. This results in a very accurate way of determining the subjects hearing threshold at different frequencies. The test begins with the right ear, presenting each frequency at a predetermined time and after the last frequency, the left ear is tested in the same way.

Features

This instruments audiometer has the capability of outputting any frequency within the human hearing range of 10Hz to 20KHz in 1Hz resolution. Up to 16 different frequencies' can be tested in one test or a sweep over a selectable range can be done. Testing time for each tone or for the entire sweep is adjustable. The test results are either stored on a Smartcard or outputted on RS-232 to a special PC software. You must have this software to see the result of the test.

Audiometer settings

1 - Frequencys
2 - Times
3 - Freq. sweep Off
4 - More. . .

Press 3 in the main menu then 1 to enter the Audiometer menu and from there, press 2 for settings to view the screen to the left. 3 - turns on or off sweep mode. Press 1 to select the frequency's to be tested.

Tone 1:	440Hz	On
Tone 2:	60Hz	Off
Tone 3:	125Hz	On
Tone 4:	250Hz	On

This screen shows you a list of 16 positions with different frequencies; you can browse the list with the arrow keys. Turn on or off a position with the L/R key and edit the frequency by deleting with the C key and enter a new. The list positions that are "on" are the ones that will be presented to the test subject, starting with the first position that is on. The first tone can be used to familiarise the subject with handling the volume key. In sweep mode, the sweep will start at the lowest frequency that is on, and end the sweep at the highest frequency that is on, regardless of the order they appear in the list. When the frequency's are set, press Esc and go back to the Audiometer settings menu and this time, open the Times settings by pressing 2.

Norm mode time/freq	30
0-60 sec.	30
Sweep mode time/ear	03:00
MM:SS	03:00

This screen allows you to change the time each tone is presented and the time for a sweep. Default single tone time is 30 seconds. Using 8 tones, it will take 4 min. for each ear and a total of 8 min for the entire test. The sweep mode time is entered in minutes and seconds and is the time it takes to sweep one channel, so a complete sweep test will take twice the time entered.

Go back to the Audiometer settings menu and press 4 - More...

1 - Volume sweep	
2 - Pulse tone	Off
3 - Log to Both	
4 -	

Volume sweep sets a relative value for the time it takes for the volume to go from 0 to max. Any value from 1 to 50 where 50 is the fastest time. Default is 20 and is usually the best value for a test time of 30 sec. per ear. If you decrease the test time, you need to increase the volume sweep time in order to reach max volume well within the given test time. If you press 2, Pulse tone will toggle on or off. If on, the output tone will pulse on and off about 4 times per second. 3 - toggles the destination of the audiometer test result. Serial RS-232 to PC, Smartcard or Both.

Using the Audiometer

Make sure you're PC is connected and the Audiometer software is running.

For best reliability of the test, it is very important that the test subject is in a very quiet environment, preferably in a sound cabin.

Press 1 - Run Audiometer, in the Audiometer menu and the test starts immediately.

The subject controls the test with the hand box. As soon as he/she hears the tone, he/she presses and holds down the - (minus) key. The tone will then decrease in volume and the subject releases the key when he/she no longer hears it. This pressing and releasing is continued through out the test and results in an audiogram with a "saw tooth" line plotted around the subjects hearing threshold.

Settings

- | |
|------------|
| 1 - System |
| 2 - Filter |
| 3 - Setup |
| 4 - |

Press 4 in the main menu to show the Settings menu.

- | |
|-------------------|
| 1 - Set time/date |
| 2 - SmartCard |
| 3 - Monitoring |
| 4 - More... |

Press 1 for System settings.

Press 1 to set time and date. The clock is a 24-hour clock. Time and date is used when logging to the Smartcard.

- | |
|--------------------------------------|
| 1 - New card number |
| 2 - Autosave No |
| 3 - Erase card |
| 4 - Un erase card |

Press 2 for Smartcard settings.

1 - Enter a new card number with up to 12 characters.
 2 - Autosave toggles on or off. Saves frequency list changes automatically to the inserted card after a list has been run.
 For erasing of the Smartcard, see page 5

- | |
|--------------------------------------|
| 1 - Monitor Off |
| 2 - Device num. 1 |
| 3 - Send PO data No |
| 4 - |

Press 3 in the Settings menu for monitoring setup.

This is the settings for the remote surveillance monitors.
 1 - toggles remote monitoring on or off
 2 - sets this instruments device number on the monitor network. Allowing you to have up to 9 instruments on the same network.
 3 - toggles weather or not to send pulse and oxygen data to the remote monitors. Applicable only if you have the optional Pulseoxymeter installed.

- | |
|-------------------|
| 1 - Software |
| 2 - Load defaults |
| 3 - Lowbat setup |
| 4 - More... |

Press 4 in the Settings menu for more options.

1 - shows you the current software versions in the instruments hardware.
 2 - loads default values to all settings.

- | | |
|-------------------|-----|
| Voltage Levels | |
| 1 - Lowbat LED on | 5.2 |
| 2 - Backlight off | 5.0 |
| 3 - System off | 4.8 |

3 - lowbat settings. You usually don't have to change these. 1, 2 and 3 browses allowable values for each setting.
 Setting the System off voltage to a value over the current system voltage, will result in the instrument turning off, and you will not be able to turn it on until you have charged the battery to a level over the System off voltage.

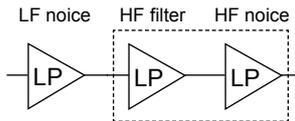
- | |
|---------------------------------------|
| 1 - Baud rate 9600 |
| 2 - Light module |
| 3 - |
| 4 - |

Even more settings by pressing 4 in the second settings menu.

1 - browses thru available baud rate settings for the RS-232 PC connection.
 2 - Optional, not yet available.

Filter Settings

- | |
|----------------------|
| 1 - System |
| 2 - Filter |
| 3 - Setup freq. list |
| 4 - |



Press 4 in the main menu to enter Settings.

Press 2 for filter settings.

The signals generated by the instrument are passed through a series of filters designed to suppress as much noise as possible. If you are only generating low frequencies, below a few hundred Hertz, you can leave all the filters on. If you are only generating high frequencies, over 50KHz, turn them off. For anything in between, the best is to set them in auto mode. In auto mode the filters will be automatically set depending on output frequency. In manual mode you enable the filters manually. There are 3 manual/auto controllable filters, 3 low pass filters, called HF noise, LF noise and HF filter.

The LF noise filter limits the bandwidth to a few hundred Hertz. With the LF noise filter on, you will still be able to hear higher frequencies, but their amplitude will be much less than the lower frequencies. The LF noise filter must be on when generating VLF frequencies in the brain wave area. The HF noise and HF filters work together. If you disable the HF filter, the HF noise filter is bypassed.

- | | |
|---------------------|-----|
| 1 - Left filter | Man |
| 2 - Right filter | Man |
| 3 - Auto settings | |
| 4 - Manual settings | |

1 and 2 toggles the filters between manual and auto.

Press 3 to edit frequencies for Auto setting of filters.

Left filter	
HF noise	500 ■ Hz
LF noise	35 Hz
HF filter	50 KHz

Change left and right filter with the L/R key.

The filter will be automatically enabled below the entered frequency.

Left filter	
1 - HF noise	On
2 - LF noise	On
3 - HF filter	On

Press 4 in the filter menu for manual settings.

1, 2 or 3 will toggle the filter on or off.

Tip!

You can test the filters effect by entering a frequency in the Single tone menu and then go in to the manual filter settings menu and try the filters.

Setup Frequency list

1 - System
2 - Filter
3 - Setup freq. list
4 -

Press 4 in the main menu for the settings menu.
Press 3 in the settings menu for Frequency list setup.

1 - Copy L to R	Yes
2 - Copy R to L	No
3 - Default time	
4 - More...	

When Copy L to R is enabled (Yes), everything you enter in a left frequency list position is copied to that position's right channel. If you mostly use the same frequency and settings in both channels, you will not have to enter them twice.

Copy R to L, copies from the right channel to the left. If both are enabled, both channels will always contain the same data and it will not be possible to enter any unique data in one channel.

3 - Default time. This is the time that automatically will be set to each list position.

4 - More...

1 - Log P. O.	10s
2 - Volume setup	
3 -	
4 -	

1 - Log P.O. will set a time for extended logging of pulse and oxygen data. The log is only accessible with special PC software and requires that the optional pulse oximeter are installed. Log time can be set from 10 to 60 seconds and result in a total log time from approximately 1 to 6 hours.

Total remaining log time can be viewed by pressing the 9 key to show Smartcard information. You can press 9 to view this information in all non-input menus.

If you have the pulse oximeter, pulse and oxygen levels are always saved at the end of every frequency list position and can be evaluated after the list has been run, explained earlier in the section "After running a frequency list".

1 - Mode: Calculate
2 - Constant value
3 -
4 -

2 - Volume setup. The volume for each list position can be automatically set to a default value or calculated to a level based on the given frequency for that list position.

1 - toggles between, use default and calculate.

Enter default volume
0 - 192, 0 = Mute
Left volume: 150■
Right volume: 150

If you choose to use a default volume, that volume is set by pressing 2 - and entering volume levels for the left and right channels. Any level from 0 to 192 may be entered. Where 0 is no output (mute), 1 is lowest and 192 are highest volume.