

Computer-powered

Wireless

Ultra-intelligent

Real-time

Monitor

(CWURM)

Version 2005.1
Patent no. 6897773

User's Manual

Computer-powered

Wireless

Ultra-intelligent Real-time

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This manual is located on the CD.
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Safety Information

- Before using this monitor, read all instructions in this manual, product labels and warnings; the loose leaf instructions for the chest strap sensor/transmitter; as well as all instructions for any peripheral devices that the monitor is connected to, such as a computer and computer related peripheral devices such as a power supply, printer and telephone.
- Use only the voltage for which the AC adapter is rated. Excess voltage may result in fire and electrical shock.
- Use only the voltage for which the AC adapter is rated. Excess voltage may result in fire and electrical shock.
- If your hands are wet, do not touch the AC adapter as doing so may result in electric shock.
- In case of a damaged power cord (internal wiring exposed or shorted), contact your original dealer to purchase a replacement cord. A damaged power cord may result in fire and electric shock.
- If the AC adapter will be unused for a long time, unplug it. Always grasp the AC adapter. Avoid pulling the power cord as that can cause damage, fire and electrical shock.
- Do not subject the monitor to large amounts of humidity or dust, as that may result in fire and electrical shock.
- Do not place the monitor on an unstable or tilted surface as it may fall, resulting in damage or personal injury.
- Always dispose of a Polar® Wearlink belt 'used battery' according to government regulations.
- Under no circumstances should the Long Range Receiver, Repeater or Short Range Receiver be opened, taken apart, or modified in any way. Any such action may result in fire and electrical shock. If the rechargeable battery in the repeater is worn out, contact your original dealer to purchase a replacement battery. The dealer will install the battery.
- If the monitor is emitting smoke or a strange odor, turn it off immediately and unplug the AC adapter from the wall outlet. Contact your original dealer to request servicing.

Computer-Powered Wireless Ultra-Intelligent Real-Time Monitor

This monitor is a reference device.

General User Information

CWURM is a multifunction vital signs monitor suitable and convenient for use in private homes, gymnasiums, sports, nursing homes and hospitals. It is ideal for use as a baby monitor. It is also a high performance, mobile and fully integrated heart monitoring system to help in the analysis of fitness, performance, and health for the average active adult.

Unlike other heart monitoring devices that only detect high or low values in heart rate, CWURM provides a comprehensive method for reading and interpreting data. It monitors and reports heart rate activity in excess of user-specified limits, as well as irregular heart rate fluctuations (by calculating the frequency of changes in the user's heart rate). CWURM defaults to average norms depending on the user's age and sex (reference 6,7). It also automatically customizes to each individual user after collecting data for only a short period of operating time. The information is displayed in real time, which facilitates rapid observation of abnormal conditions so that corrective action can be taken immediately. Archived data (1 year) may be reviewed for cardiac rehabilitation.

The short range monitor has a wireless range of 3 feet. It is safe for babies. Also the chest strap is a welcome alternative to skin irritating gels and wires. The long range monitor has a wireless range of 1000 feet, and provides freedom and mobility. Both monitors provide continuous up to date charts and graduated sound and full screen color alarms, as well as a worldwide telephone alarm. The user or caregiver decides when to take action, so there are no false alarms.

Professional Edition User Information

A single computer can be used to create a multiple user integrated Nurse's Station or Physical Trainer's Station. User administrative data are encrypted and stored along with historical charts. Charts are separated into internal biological effects and external environmental effects, in terms of actual values and standard deviations, to speed up and improve data analysis. A spectral analysis of any desired transformation of any segment of 24 hour beat to beat and inter-beat data is easily produced. CWURM is easy to use and ideal for use at a medical establishment, gymnasium or at home. Due to very low frequency {5kHz} and short range {3feet}, interference with other equipment in a hospital or gymnasium is easily avoided (references 1,2,3,4,5).

Refer to section titled Applications for more information on monitoring.

Installing the CWURM Heart Monitoring Software

NOTE: System Requirements. Before proceeding verify the following minimum operating system, speed and RAM memory requirements for your computer.

Speed 500MHz

**To continuously monitor History and Standard Deviation charts:
Windows 98 64 Mega Bytes
or above
Windows XP 256 Mega Bytes**

**To continuously monitor Common cause and Special cause charts:
- 1 Giga Byte (Professional Edition)**

Insert the Heart Monitoring Software CD into your computer's CD-ROM / DVD-ROM drive.

The CWURM Software Setup Wizard will launch automatically. If not double-click the desktop 'My Computer' icon, double-click the CD ROM drive icon, and double click on the Setup.exe icon. Follow the Setup Wizard's installation instructions. The default folder where the software program will be installed is CWURM.

NOTE: The CD ROM drive contains USB drivers that are required for the CWURM Receiver. The setup wizard will copy the drivers to the installation folder CWURM. This will allow you to install additional receivers without the CD.

Installing the CWURM Heart Monitoring Hardware

1. Installing the CWURM Heart Monitoring Hardware on your computer

In order to install the CWURM Heart Monitoring device, you must have an available USB Port.

Insert the USB Cable that is connected to the CWURM Receiver into an available USB Port on your computer, as shown in the diagram below.



Short range receiver (no antenna) **must be at least 1 foot away the computer.**
Long range receiver (with antenna) may touch computer.

The windows device manager will appear on the screen, and will automatically locate and install the receiver device drivers that are located on the CWURM installation CD and in the installation folder CWURM. Click next.

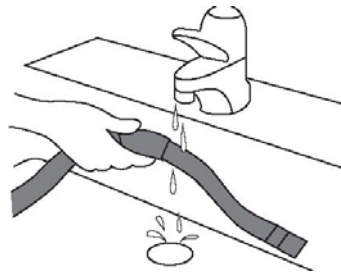


2 - Installing the CWURM Heart Monitoring Hardware on the Person to be Monitored

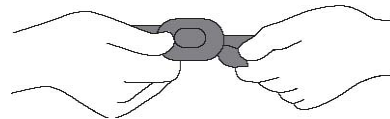
Follow the instructions below which pertain to the Polar® Heart Rate Transmitter Model you are using.

Either: Polar® Wearlink™ Heart Rate Sensor/Transmitter:

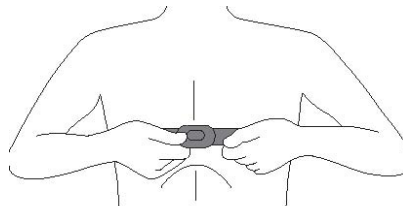
- a. Moisten the electrode areas of the strap under running water and make sure they are well moistened, as shown to the right.



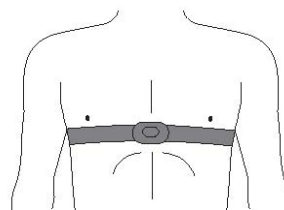
- b. Attach the connector to the strap. Attach the connector's letter "R" to the letter "R" on the strap and snap the fastener, as shown to the right.



- c. Adjust the strap length to fit snugly and comfortably. Secure the strap around your chest, just below the chest muscles for men, and below the breasts for women, and snap the second fastener.

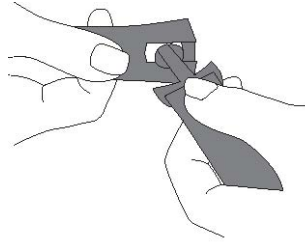


- d. Check that the wet electrode areas are firmly against your skin and that the Polar logo of the connector is in a central, upright position.

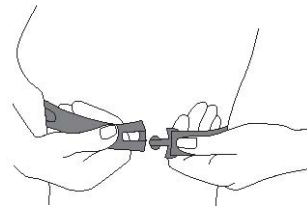


OR: Polar® T61 Heart Rate Transmitter:

a. Attach the Polar® T61 Heart Rate Transmitter to the elastic strap, as shown to the right.

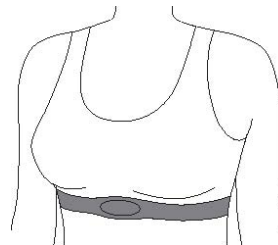


b. Adjust the strap length to fit snugly and comfortably. Secure the strap around your chest, below the chest muscles for men, and below the breasts for women. Lock the buckle, as shown to the right.



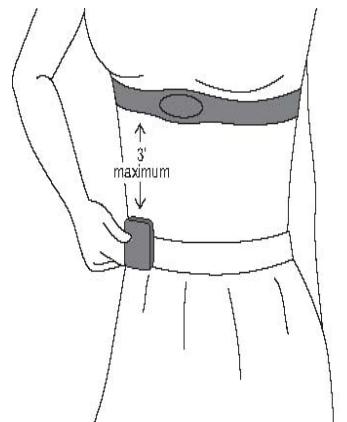
c. Lift the Polar® Heart Rate Transmitter off your chest and moisten the grooved electrode areas on the back of it.

d. Check that the wet electrodes are firmly against your skin and the Polar® logo is in a central upright position, as shown to the right.



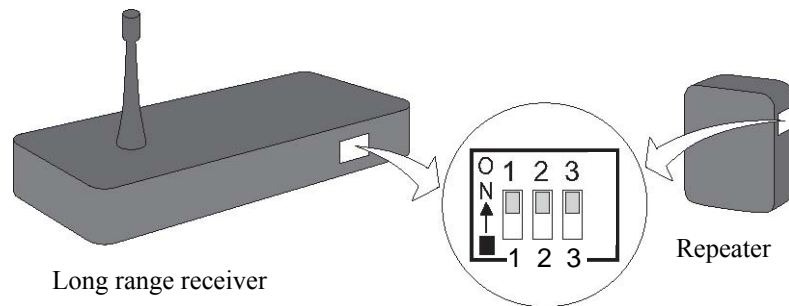
NOTE: The following step is only necessary when using the Long Range CWURM hardware configuration.

e. Attach the CWURM Signal Repeater within 3 feet of the Polar® Heart Rate Sensor/Transmitter, to an area such as your belt, waistline, or pocket, as shown to the right. The repeater may also be placed under your mattress, recharged and operated normally while you sleep, so that monitoring is non-stop.



3 - Setting The Frequency Switches (Long range monitor only)

The CWURM Signal Repeater and CWURM Receiver use wireless technology (radio waves) to transmit information. Therefore, it is essential that they are set to the same radio wave frequency. As shown in the diagram below, set the frequency switches on the CWURM Signal Repeater and CWURM Receiver to the same positions. Here, they are all in the up (ON) position.



For further information on frequency settings, refer to Appendix B.

4 - Charging the CWURM Repeater

The CWURM Repeater is equipped with a rechargeable battery. It must be fully charged before first use. It is recharged by connection to the provided A/C Adapter, which is plugged into an electrical wall outlet. While recharging, the LED indicator light blinks rapidly. When fully charged, the LED light remains on. The first full charge will be achieved in 5-7 hours if the Repeater is turned ON (fast charge mode). Subsequent fast recharges may require as little as one hour. It will slow charge (about 24 hours) when the repeater is turned OFF. The repeater operates normally while it is being recharged. When it is disconnected from the charger, and is outside the range of the chest strap, the LED will blink once every 5 seconds. When placed within 3 feet of the chest strap, it will blink once for every heart beat. Never leave the battery in a discharged state, as doing so, will damage it. A damaged battery will not hold charge. Always charge it fully before storing.

5 - Deactivating Screen & Computer Power-Saving features (Required)

Prior to using the CWURM Monitor, it is required that you turn off your computer's screen saver, as well as any power-saving options, such as Sleep Mode and Hibernate Mode. Also, turn off all other systems and programs that are unrelated to and/or not required by the CWURM monitor.

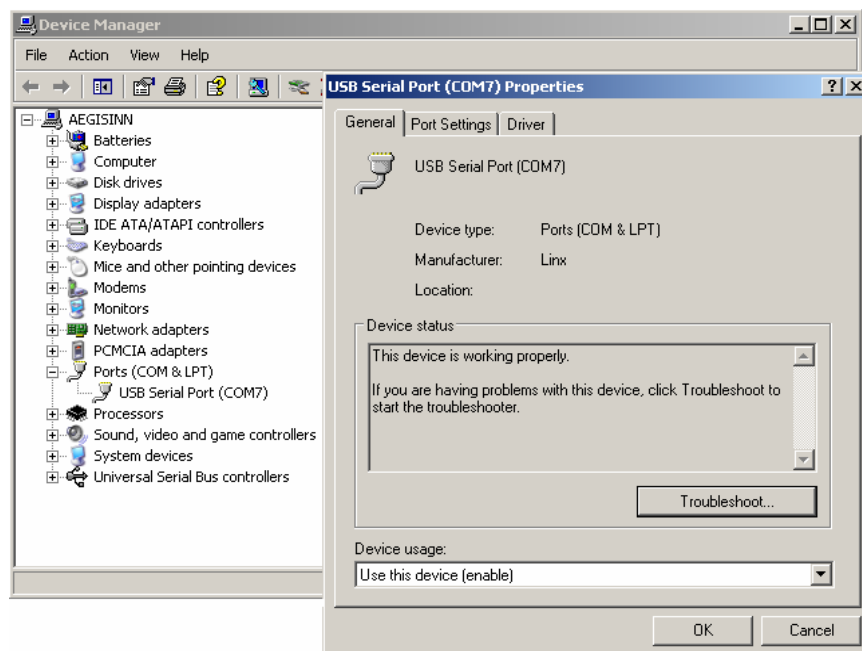
For details on this step refer to Appendix D.

Launching, Utilizing, and Customizing CWURM Software

Important First Steps

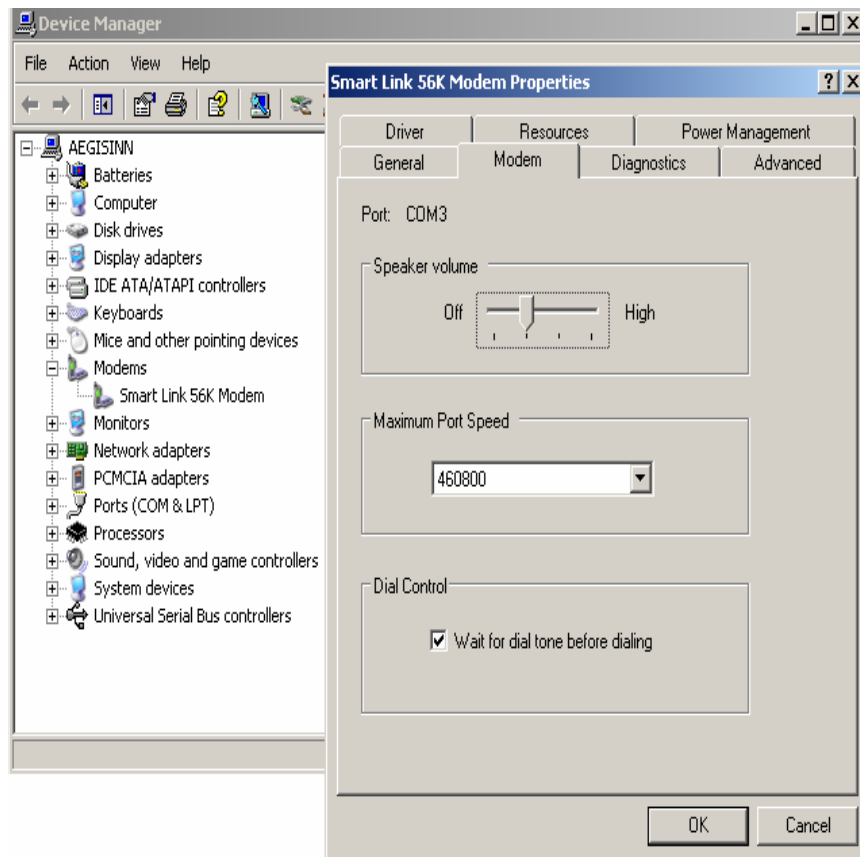
1-Identify the USB COM Port to which the CWURM Monitor is connected:

- Double-click on Display Device Manager icon (shown to the right) on your desktop.
- Scroll down and double-click on Ports (COM & LPT). Double-click on USB Serial Port (COM#) for details.
- Make a note of the USB Port (7 in this example) to which the CWURM receiver is connected (if necessary, unplug and plug in the receiver). Use a printed number sticker to mark the receiver with the COM port number. You will need it to customize the monitor as explained in the next section.



2 -Identify the Modem COM Port to which your modem is connected:

- Double-click on Display Device Manager icon (shown to the right) on your desktop.
- Scroll down and Double-click on Modems. Double-click on the listed modem.
- Make a note of the Modem Port COM number (3 in this example) to which the telephone line is connected. You will need it to customize the monitor as explained in the next section.



Launching the CWURM Software

Double-click on the CWURM Monitor program icon on your desktop. Alternatively, click on the windows task bar Start/All Programs/CWURM/CWURM. If this is the first launch, the program will start and take you directly to the Customize Screen.

Utilizing the Software

There are three main processes to learn when utilizing the CWURM Heart Monitoring Software. They are: 1) Customizing the CWURM Monitor; 2) Starting the CWURM Heart Rate Monitor; 3) Reporting. These are described in detail below.

1 - Customizing the CWURM Monitor

Each user must have a unique profile set up before using the CWURM Monitor. The steps for creating each profile are as follows. On the Main Menu Screen, click *Customize*. This will take you to the user-profile customization screen.

PROFESSIONAL EDITION Double click to set PASSWORD (optional)

Name of person being monitored: Jonathon [Add] [Delete]

Social Security Number (optional): []

Contact information (optional): []

Care giver (optional): []

Type of monitor: 1 Wireless heart monitor []

Serial port (monitor): 03 []

Age group: Walk about mode []

Sex: [Male] [Female]

Automatic Phone alarm

Automatic Print alarm

[Advanced options] [Save] [OK]

Explanation

General instructions.

Some of the control values are set automatically during this customization process.

This customization process also gives you an opportunity to change the values.

To change these values click 'Advanced Options' and then click 'Customize Further.' Finally, to save the changes, click Save.

WARNING! You must turn off all screen savers and deactivate sleep mode, hibernate mode and any other automatic power shutdown options. To do so click on the desktop POWER Configuration Options icon, or click on My Computer/Control Panel/Power Management or Options.

WARNING! By using this non-medical product, the user accepts full and complete responsibility for the proper operation of the user's computer system to alarm when biological vital signs data fall outside any predetermined user

Defaults

Standard deviation alarm threshold: 3 []

Alarm criterion: Duration of breaches []

Time before printer/telephone alarm: 15 [] Minutes

Time between chart updates: 1 [] Seconds

Display history: Most recent data only [] Minutes []

NOTE: Unless otherwise specified, all data fields require an entry.

- i. **Set Password** (*Optional*)– Near the top-right corner of this screen, you will see Set Password. If you double-click on *Set Password*, a screen will open in which you can set a password that will restrict access to the Custom Settings.

NOTE: If you no longer want password protection, set the password to ‘no’.

- ii. **Name of Person Being Monitored** – If you plan to monitor a previous user, open the drop-down menu (Professional Edition) and click on that person’s name. If you are entering a new user, type the user’s name into the appropriate field and click *Add*. The name you choose will appear on all output text and charts.
- iii. **Social Security Number** – Enter the user’s social security number in this field. This information is strictly used as a unique identifier for each user.
- iv. **Contact information** (*Optional*) – Enter the user's address and telephone number.
- v. **Caregiver** (*Optional*) – In this field enter the name of the caregiver or supervisor of the person being monitored (user). This person’s name will appear on all output text and charts.
- vi. **Type of Monitor** – In this field, select 1 Wireless Heart Monitor from the drop down menu. This identifies the type of monitor being used.
- vii. **USB Port (Monitor)** – In this field, specify the number assigned to your computer’s USB COM Port where the CWURM Monitor is connected. (See instructions on page 11.)
- viii. **Age Group** – In this field, select the age group of the person being monitored. Normal pulse rates vary depending on age and sex. The CWURM software contains pre-selected default settings for each age range and sex. These pre-selected choices are for a person who is at rest, sitting down, or sleeping. If the person being monitored will be walking around or exercising, their pulse will normally rise far above their resting pulse rate. In this case, select Walk About Mode from the dropdown menu. This will prevent excessive false alarms from occurring. The lower pulse limit will be set to 50 bpm, but there will be no effective upper limit. An alarm will still

be activated if there is a sudden, large increase or decrease in pulse rate (greater than the preset limits on the standard deviation chart.)

For further information on pre-selected default settings, refer to Appendix C.

- ix. **Sex** – Select the sex of the person being monitored.
- x. **Automatic Phone Alarm** – Check this box to activate a feature which automatically dials user-specified phone numbers in the event that any chart for the person being monitored turns red. The phone alarm will continue to ring until the charts are no longer red. Once this box is checked, a new screen will open, requesting information for options a through i below.

The screenshot shows a software configuration window with a blue title bar and an orange background. On the left is a vertical sidebar with labels: "Name of person", "Social Security N", "Contact informati", "Care giver (optio", "Type of monitor" (with "1 Wireless heart" selected), "Serial port (monit", "Age group" (with "Walk about mod" selected), and "Sex" (with "Male" selected). The main area contains several input fields: "Phone number" (Remote, Local, Remote #2, #3, #4, #5) with "Prefix" and "Number" sub-fields; "Modem Com Port" (dropdown set to "04"); "Baud Rate" (dropdown set to "19200"); "Fax Number" (Prefix, Number (optional), Email address (optional)); and an "Explanation" box with text about the alarm system. At the bottom, there are checkboxes for "Automatic Phone alarm" (checked) and "Automatic Print alarm" (unchecked), along with "Advanced options", "Save", and "OK" buttons. On the right side of the main area, there are buttons for "Test Remote Phone", "Test Local Phone", and "Test Remote #2" through "#5". A "Hang Up" button is also present.

IMPORTANT NOTE: In order for the Automatic Phone Alarm to operate, your computer must have a modem with an assigned COM Port (see g below), and an active telephone line must be connected to your computer.

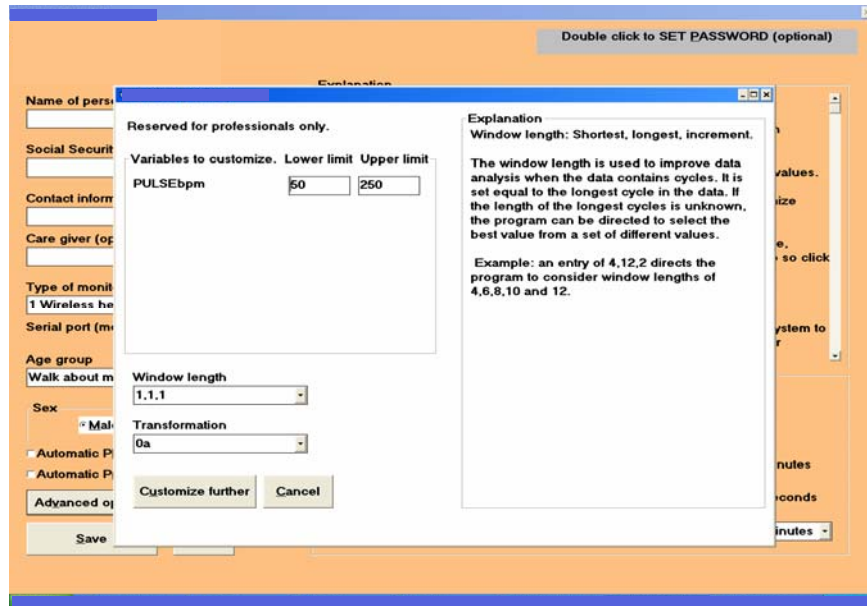
- a. Remote Phone Number – This number will be dialed if any chart remains red (due to heart activity in excess of the user-specified limits) for a user-specified period of time (See Time Before Printer/Telephone Alarm on Customize screen.) It may be used to notify a relative, friend, neighbor, or service provider at a remote location. If this number is omitted, both remote and local telephone alarms will be deactivated.
The CWURM software allows you to enter up to 5 Remote Phone Numbers.
- b. Test Remote Phone – This button is used to test the Remote Telephone connection. The modem will dial the user-specified Remote phone number. These instructions also apply to the (*optional phone number*) buttons labeled “Test Remote Phone Number #2, #3, #4, #5.”
- c. Local Phone Number – This number will be dialed if any chart becomes red (due to heart activity in excess of the user-specified limits) for any amount of time. It may be used to notify the person being monitored and who may have traveled outside the listening or viewing range of the computer. For example, this could be the number to the cell phone that the user carries.

NOTE: You must enter a Remote Phone number in order for the local Phone number to be activated.

- d. Test Local Phone – This button is used to test the Local Telephone connection. The modem will dial the user-specified Local phone number.
- e. Hang Up – This button is used to end or disconnect any test call.
- f. Fax Number (*Optional*) – This number may be used by you, a caregiver / supervisor, or a service provider to fax charts to another caregiver / supervisor. Charts may also be copied and pasted into word processor documents and faxed manually.
- g. Modem COM Port – In this menu, select the Modem COM Port to which your modem is connected. Please be sure to select the correct COM Port for the modem you would like to use.

- h. Baud Rate – In this menu, select your telephone’s Baud rate. If you do not know the baud rate, consult your telephone provider’s user manual, or contact your telephone provider for details.
 - i. Email Address (*Optional*) – This address may be used by you, a caregiver / supervisor, or a service provider to email charts to another caregiver / supervisor. Charts may also be copied and pasted into word processor documents, and manually attached to emails. In order for this option to operate successfully, your computer must have a stable Internet connection.
- x. **Automatic Print Alarm** – Similar to the *Automatic Phone Alarm*, this feature automatically prints charts in the event that the charts of the person being monitored becomes red. The print alarm will only be activated if the user’s charts have been red for longer than five minutes. The charts will be printed only once.
- xi. **Advanced Options** – ADVANCED OPTIONS ARE RESERVED FOR PROFESSIONALS WITH EXPERTISE IN THE VARIABLES BEING MONITORED, AND/OR PROFESSIONALS WITH EXPERTISE IN MATHEMATICAL MODEL BUILDING.

Click on the *Advanced Options* button, and a new window will open, giving you the following options.



- a. Variables to Customize – This customization process allows you the opportunity to change the upper and lower control settings independently. To set the alarm for the chart of actual values, enter the lower & upper absolute limits for the variables listed (you should see only “PULSE bpm”).
- b. Window Length – This feature can be used to improve data analysis when the data contains cycles. It is set equal to the longest cycle in the data. If the length of the longest cycle is unknown, the program can be directed to select the best value from a set of different values. (See explanation on screen for more details.)
- c. Transformation – The following differencing, power, and antithetic transformation options are available to improve data analysis.
 - i. 01 = No transformation
 - ii. 0* = No differencing + power + no antithetic
 - iii. 0a = No differencing + no power + antithetic
 - iv. 0A = No differencing + power + antithetic
 - v. 11 = Differencing + no power + no antithetic
 - vi. 1* = Differencing + power + no antithetic
 - vii. 1a = Differencing + no power + antithetic
 - viii. 1A = Differencing + power + antithetic

Once you have the settings configured properly, click on *Customize Further* to accept these settings.

**For further information on Window Length and Transformation, please visit our website.

xiii. **Standard Deviation Alarm Threshold** – Use this menu to select your desired standard deviation threshold. The automatic sound and color alarms are activated when the CWURM Monitor is running and there is a relatively sudden change in any heart rate that is greater than the specified standard deviation threshold. This information is shown on the standardized chart, and is based on relative heart rate change – which means that it automatically customizes to the individual being monitored, regardless of age or sex. **For further information on standard deviation, refer to Appendix A.**

xiv. **Alarm Criterion** – Use this field to select the criteria by which you want the alarm to initiate. You will have the following options:

- a. Number of Breaches – This selection identifies the number of times either the upper or lower control limit of a chart is exceeded.

NOTE: If you select Number of Breaches as your alarm criteria, you must specify your desired number of breaches in the No. of Breaches Before Phone Alarm field. If the number of breaches is five or less, only the telephone alarm will be activated. If the number of breaches exceeds five, the print alarm will be activated as well.

- b. Duration of Breaches – This selection identifies the length of time that either the upper or lower control limit is exceeded.

NOTE: If you select Duration of Breaches as your alarm criterion, you must specify your desired time before the alarm is activated by selecting a time period in the Time Before Printer/Telephone Alarm Field. If the duration of consecutive breaches is five minutes or less, only the telephone alarm will be activated. If the duration of consecutive breaches exceeds five minutes, the print alarm will be activated.

- xv. Time Before Printer / Telephone Alarm – In this field, select the number of minutes you want the CWURM System to allow a breach to occur before it activates the Print Alarm or Phone Alarm. Keep in mind that the Print and Phone Alarms must first be enabled in order to be activated.
- xvi. Time Between Chart Updates – In this field, enter the viewing time (1 to 10 seconds per chart) between which the charts are to be updated. The data will be collected as changes occur, and held in memory for periodic updating of the chart.
- xvii. Display History – This field allows the user to increase or decrease the charting observation interval, in either minutes or hours.

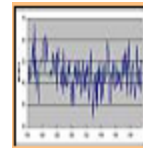
NOTE: A short display history will result in a more responsive chart and alarm system. A long display history will result in a less responsive chart and alarm system.

Once all Customize settings are correct, click *Save*, then *OK* to exit the Customize Screen.

2 - Starting the CWURM Heart Rate Monitor

There are two methods you can use to start the CWURM Heart Monitor. They are:

- a. On the Main Menu Screen toolbar, click *Start Monitor*. In the drop-down menu, click *Start Monitor (CWURM)*.
- b. **Shortcut** – On the Main Menu Screen, click the icon shown to the right.



Either one of these methods will take you to the start menu (*shown below*), prompting you to select your charts and starting mode.



IMPORTANT NOTE: Before proceeding, you must select the appropriate user and settings in the Customize Menu. If you have already done so, you may proceed.

You may select from the following options.

i. **Selecting the Charts to be Displayed**

There are four chart types to select from, as well as several dual-chart options (displays more than one chart on the screen). They are explained below.

Single Chart Options:

- a. **History Chart** – This is a simple chart containing actual heart rate data.
- b. **Standard Deviation Chart** – This chart depicts the heart rate data in terms of standard deviations. It detects changes in the data that are sudden and unusual, when compared to earlier changes.
- c. **Special Cause Chart** (Professional Edition) – This chart type depicts random effects, such as irregular pulse rates, or brain wave fluctuations due to external environmental stimulation.
- d. **Common Cause Chart** (Professional Edition) – This chart type depicts systematic effects, such as systematic internal biological changes in heart rate.

Dual-Chart Options (Professional Edition):

- e. **History & Special Cause**(Professional Edition) – This option will display both a History Chart and a Special Cause Chart on one screen.
- f. **History & Common Cause** (Professional Edition) – This option will display both a History Chart and a Common Cause Chart on one screen.
- g. **Special Cause & Common Cause** (Professional Edition) – This option will display both a Special Cause Chart and a Common Cause Chart on one screen.

NOTE: All selections involving Common cause or Special cause charts (Professional Edition) require 1 Giga Byte of RAM memory.

IMPORTANT NOTE: The CWURM heart monitoring system reads heart rate data from a remote device worn by the user being monitored, and sends alerts via print (if selected) and telephone (if selected) to user-specified destinations when the user's heart rate activity or standard deviation threshold are in excess of user-specified limits. These "excesses" are referred to as breaches. If the user's heart rate activity or standard deviation thresholds exceed these user-specified limits, the chart color on your screen will change as follows:

1. Blue – This occurs after the software detects one breach.
2. Yellow – This occurs after the software detects two consecutive breaches.
3. Red – This occurs after the software detects three consecutive breaches.*

*If the print and phone alarm have been selected, they will be activated after the chart color remains red for a user-specified length of time (refer to *Time Before Printer / Telephone Alarm* above). Once activated, the phone alarm will continue to ring until the chart is no longer red, or the alarm is reset via user intervention. (The alarm may be stopped and reset by clicking STOP on the *Main Menu Screen*.)

ii. **Selecting the Starting Mode**

There are three Starting Mode selection options, listed below.

- a. **Create New Chart** – If this is selected, new charts will be created and updated continuously.
- b. **Resume** – If the monitor is running, but must be stopped for any reason, you may select this option to resume monitoring from the previous stopping point.
- c. **Restore** – If 'Create New Chart' is inadvertently selected, and the monitor is started, you may recover by stopping the monitor, selecting 'Restore', and starting the monitor once again.

Noise Filter

The noise filter eliminates any incoming data value that is different from the immediately preceding data value by the percentage specified.

Click *Continue* to accept your selections and start the monitor.

IMPORTANT NOTE: The first time you attempt to start the CWURM Heart Monitor after installation, a customer code will appear on the screen and you will be prompted for an activation code (one time only). The software will not work without it. In order to obtain the activation code via e-mail, do the following:

- 1. Establish an internet connection**
- 2. Visit our website**
- 3. Follow the website instructions to email the customer code and request for activation code.**
- 4. The activation code will be sent to you by return email.**

IMPORTANT NOTE: If you are paying for the monitor in installments, you will receive a temporary activation code. This code will expire in an allotted time if full payment is not received as agreed.

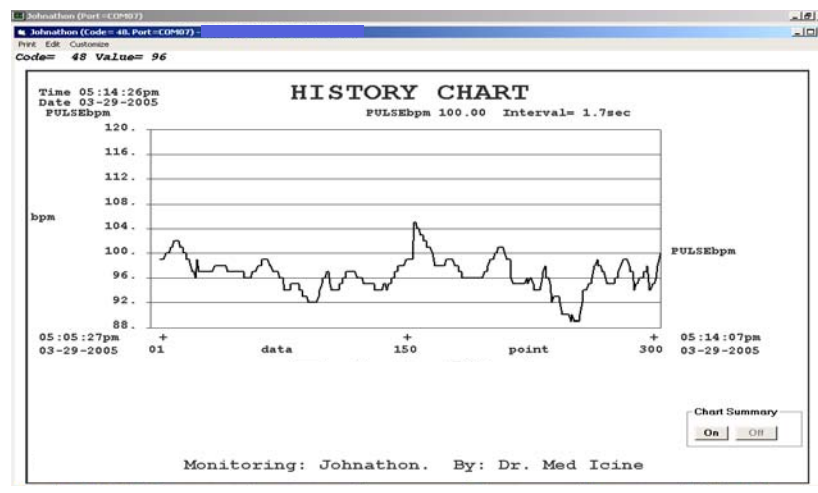
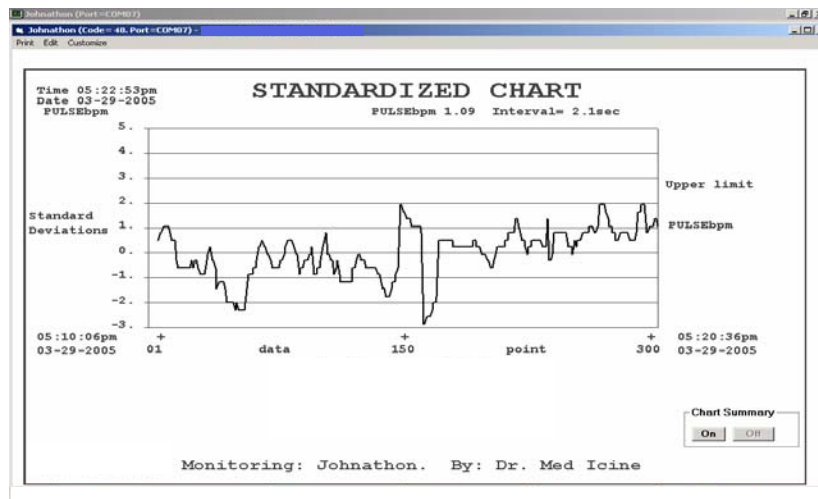
If you do not have an e-mail connection, call by telephone. You must call this number to receive your CWURM Software Activation Code.

Once you receive the activation code, enter it. The monitor will begin searching for the coded signal being sent from the coded transmitter (only a coded transmitter must be used). The short range user must stay within 3 feet of the receiver. The long range user must start out close to the receiver (with the repeater turned on), but can travel up to 1000 feet away after the charts appear on the computer screen. Once the signal is detected, no other signal with a different code will be accepted.

NOTE: If the chest strap is removed for more than 10 seconds, the code will change. The monitor will no longer recognize it. In that case the monitor must be restarted.

The charts will appear next. Of the many charts available, two are shown below. The standardized chart is the same as the history chart, except that it is rescaled in terms of standard deviations. The history and standardized charts shown below are for different time periods.

Continuous Updating The charts will be updated continuously as new incoming data are received. To temporarily pause updating, so as to read a chart, click on maximize (☐ in top right corner). To resume updating, click on restore (☐).



- iii. **Simultaneous Monitoring of Multiple Users** (Professional Edition) –
The CWURM Heart Monitoring System can be utilized in a multi-user environment, and has the capacity to simultaneously monitor several users. The number of users that can be monitored on one computer is, however, limited to your computer's available system resources (due to the high level of processing) and number of available USB Ports. Below are instructions for monitoring 2 or more users simultaneously.

In the case of short range monitors, each monitor must be used with its own receiver, connected to a separate USB port and spaced at least 3 feet apart.

The long range monitors may share a common receiver. However, if only one receiver is installed and the number of monitors is excessive, they will interfere with each other. In that case interference can be reduced by adding more receivers and operating them at different frequencies. Verify that the light on the repeater is on and flashing. Make sure that the transmission code detected by the computer is for the correct sensor/transmitter and no other sensor/transmitter that could be in use within the transmission range of the receiver. Do this by starting the monitor while the user is close to the receiver, and is wearing the sensor/transmitter. This will give the wearer of the sensor/transmitter priority in the event that there is another transmitter operating at the same frequency and within the range of the receiver. When starting a new monitor, all monitors that are already running may be left on. However, only one new monitor at a time can be started. Therefore, the monitor that you are starting must be the only new one turned on. All other monitors not yet started must be turned off.

- a. Launch the CWURM Program by double-clicking the *CWURM Program* icon on your desktop.
- b. Enter the *Customize Menu* by clicking *Customize*.
- c. Select the first user to be monitored.
- d. Click *Save*, then click *OK*.
- e. On the *Main Menu* Screen, click *Start Monitor* then *Continue*. The CWURM Program will begin monitoring User #1.
- f. Minimize the CWURM Program application and the user's chart.

- g. Launch a second application (Professional Edition) of the CWURM Program by double-clicking the *CWURM Program* icon on your desktop.
- h. Enter the *Customize Menu* by clicking *Customize*.
- i. Select the second user to be monitored.
- j. Click *Save*, then click *OK*.
- k. On the *Main Menu Screen*, click *Start Monitor* then *Continue*. The CWURM Program will begin monitoring User #2.
- l. Minimize the CWURM Program application and the user's chart.

NOTE: Each chest strap (sensor/transmitter) is coded. If a message appears stating that the transmission code you are searching for is already being used by the first monitor, you must change the code before continuing. If the monitor is a chest strap, the code may be changed by raising the front part of the strap (the sensors) off the skin for at least 10 seconds, then replacing it.

The center console (Nurse's station or Physical Trainer's station) contains a list of the persons being monitored as shown below.

<i>NAME</i>	<i>PULSEbpm</i>
<i>Johnathon</i>	<i>102</i>

To monitor additional users (Professional Edition), simply repeat the steps listed above. All persons being monitored must be at least 3 feet apart. The names of

additional users will be added to the above center console.

At any time, any user's chart may be restored for normal viewing. Under normal conditions the user charts will remain minimized. However, if there is a loss of signal or if a telephone alarm is initiated, the related user chart will automatically be restored for viewing.

- iv. **Stopping the CWURM Monitor** – To stop the monitor, restore (click on) the main menu monitor window and minimize (click on -) the window that contains the charts to expose the main Monitor Screen.



Next, click on the Stop icon (shown to the right.)

At this point, you will be prompted to select whether or not you would like to print all charts from the monitoring session.

- If you select *Yes*, the charts from your session will print, and you will be prompted to select whether or not you want to terminate the monitor.
- If you select *No*, you will be prompted to select whether or not you want to terminate the monitor.
 - If you select *Yes*, the monitor will terminate, ending the session, and you will be prompted to select whether or not you want to exit the CWURM program.
 - If you select *Yes*, the CWURM program will exit.
 - If you select *No*, you will be returned to the *Main Menu Screen*.
 - If you select *No* (to not terminate the monitor), the monitor will continue to run, and you will be returned to the *Main Menu Screen*.

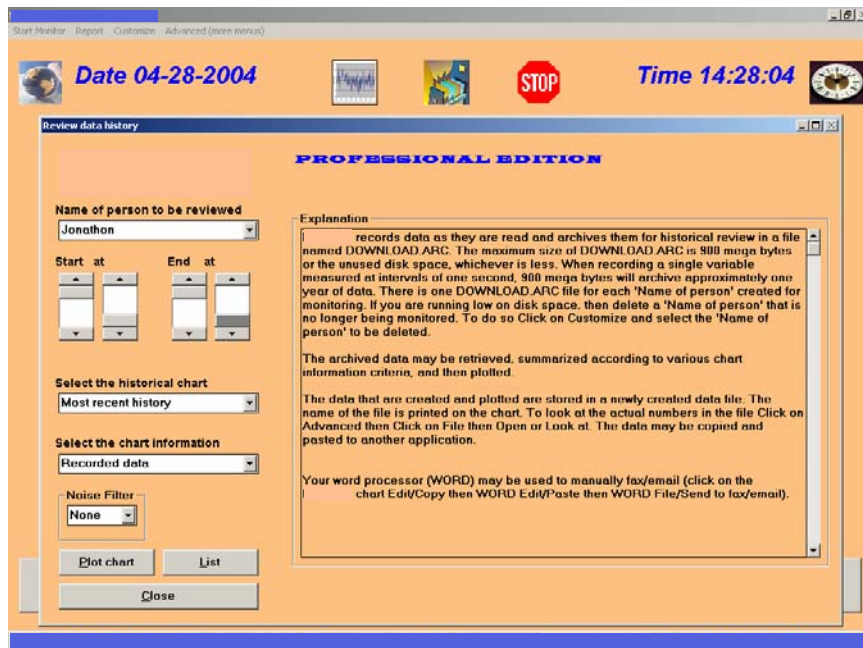
3 – Reporting

There are two methods you can use to enter the CWURM *Report Menu Screen*. They are explained below.

- a. On the *Main Menu Screen*, click *Report*. In the drop-down menu, click *Review Data History*.
- b. **Shortcut** – On the *Main Menu Screen*, click the icon shown to the right.



Either one of these methods will take you to the *Report Menu* (shown below).



i. **Name of Person to be Reviewed**

Open the drop down menu box. If you just started CWURM, you will see all the names of persons that were entered from the customize menu (see customizing the CWURM monitor). If you were monitoring a person and just stopped the monitor, the drop down menu will show only the person who you were monitoring. In that case the name must be changed using the customize menu. In either case, click the name of the person to be monitored.

ii. **Selecting the historical data to be reviewed.**

a. Start at

Use the vertical scroll bar labeled *start at* to select the starting position and date of the data to be reviewed.

b. End at

Use the vertical scroll bar labeled *end at* to select the ending position and date of the data to be reviewed.

iii. **Select the historical chart.**

Open the drop down menu box. The listed options are defined as follows:

- a. Most recent history.
Contains the most recent data values read and recorded by the monitor.
- b. Minutely history.
Data are aggregated and summarized into intervals of one minute each.
- c. 5 Minutely history
Data are aggregated and summarized into intervals of five minutes each.
- d. Hourly history.
Data are aggregated and summarized into intervals of one hour each.
- e. Daily history.
Data are aggregated and summarized into intervals of one day each.

For 'a,' select: 'Recorded data', or 'Time between records' (this represents interbeat time in the case when each record corresponds to a heart beat).

For 'b-e,' select: Average, Maximum or Minimum values.

Noise Filter The noise filter excludes any recorded data value that is different from the immediately preceding data value by the percentage specified.

iv. **Plot chart**

Click on *Plot* to create a chart of the data selected.

v. **List**

Click on *List* to display the historical data selected.

vi. **Close**

Click on *Close* to end reporting and return to the main menu.

4 -Advanced (More Menus) (Professional Edition)

Advanced menu options are reserved for professionals with expertise in the variables being monitored, and/or professionals with expertise in mathematical model building

The monitor archives data at the same time that they are being charted, for up to one year. The advanced menus permit additional analysis of the historical data. By using the report menu to select and plot historical data, any desired transformation of any segment of 24 hour beat to beat and inter-beat data is easily produced. For example, to display an inter-beat chart (time between beats in milli seconds), plot the chart then select the *Reciprocals* transformation.

While the chart is displayed, click on *Transformations* and select any one of the following:

Cumulate, Difference, Reciprocals, Exponentiate,
Divide by time (t), Divide by (t^{.5}),
Natural logarithms, Logarithms (base 10),
Inverse natural logarithms, Inverse logarithms (base 10),
Histogram (frequency distribution)
Spectrum (Fast Fourier transform),
Autocorrelation function (acf), Partial autocorrelation function (pacf),
Standardize (mean/standard deviation).

Each chart contains summary data and indices to assist in their interpretation.

To reconstruct the model that is used to separate the data into common cause and special cause charts, click on the main menu *Advanced(more menus)*. Then, click on *Calculate / Model Parameters*, or on the **shortcut** icon shown to the right. To display the common cause and special cause charts, click on *Report* and select the chart. To change the window length (number of data points) on which the spectrum and therefore model and charts are based, click on the main menu *File / Update*. After making changes, save the file before repeating *Calculate & Report*. If the *Report/Review data HISTORY* menu is used to select a new data segment for analysis, the window length will be reset to the values specified in the customize menu. See references 1 & 4 and our website for information to assist in the interpretation of the model and charts.

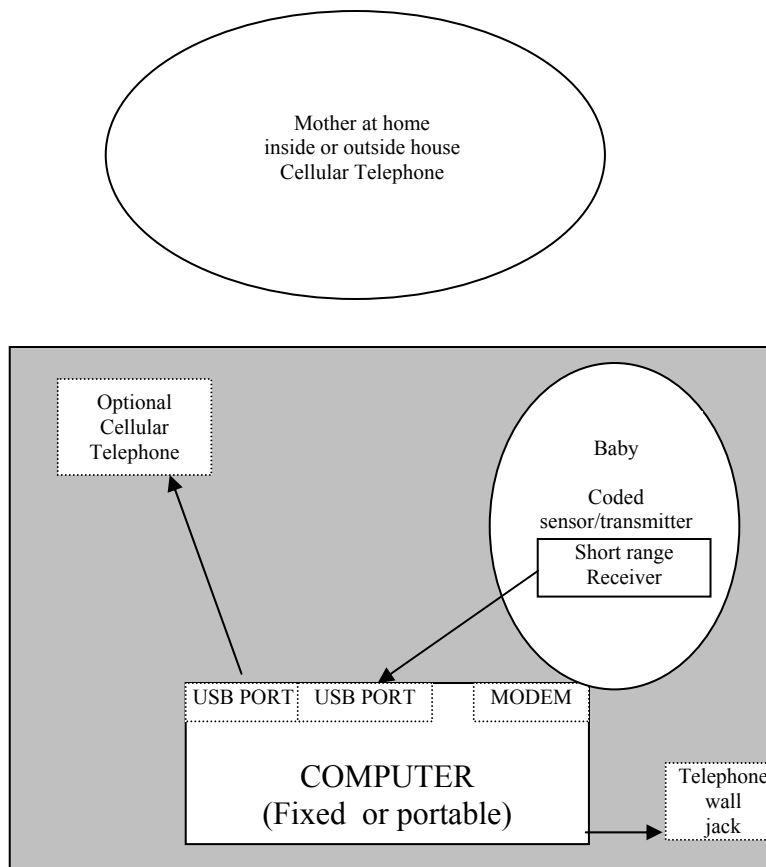


See reference 8 for heart rate analysis and applications, reported by the Task Force of the European Society of Cardiology & the North American Society of Pacing Electrophysiology. **For more detailed information visit our website.**

Applications

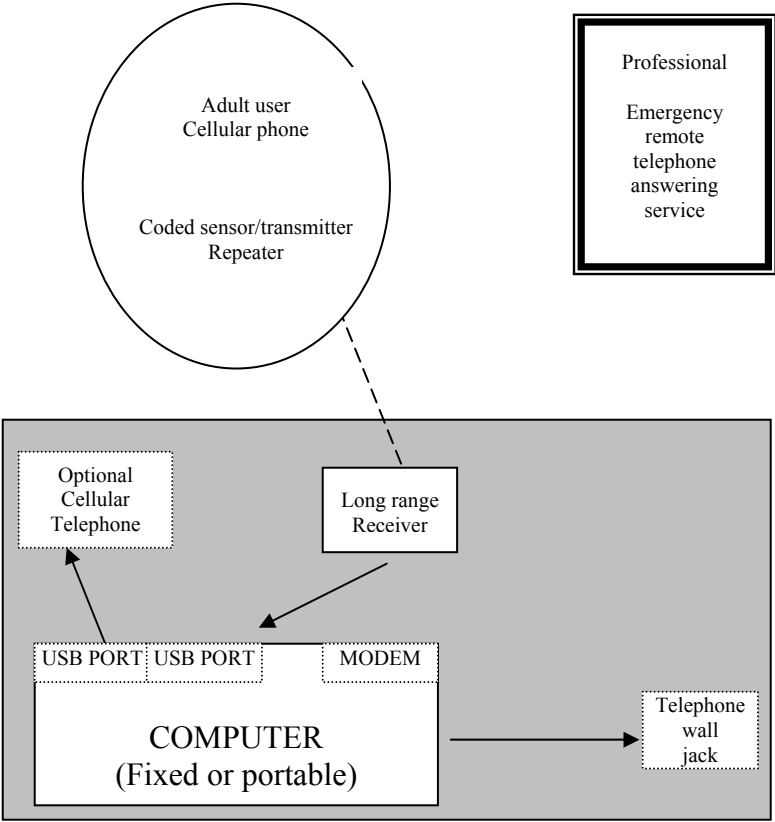
SHORT RANGE COMPUTER-POWERED WIRELESS ULTRA- INTELLIGENT REAL-TIME MONITOR SINGLE HOME USER

Baby is lying down but can adjust its body position completely free of wires.
If the computer is portable & powered by a motor car battery, then travel is possible.



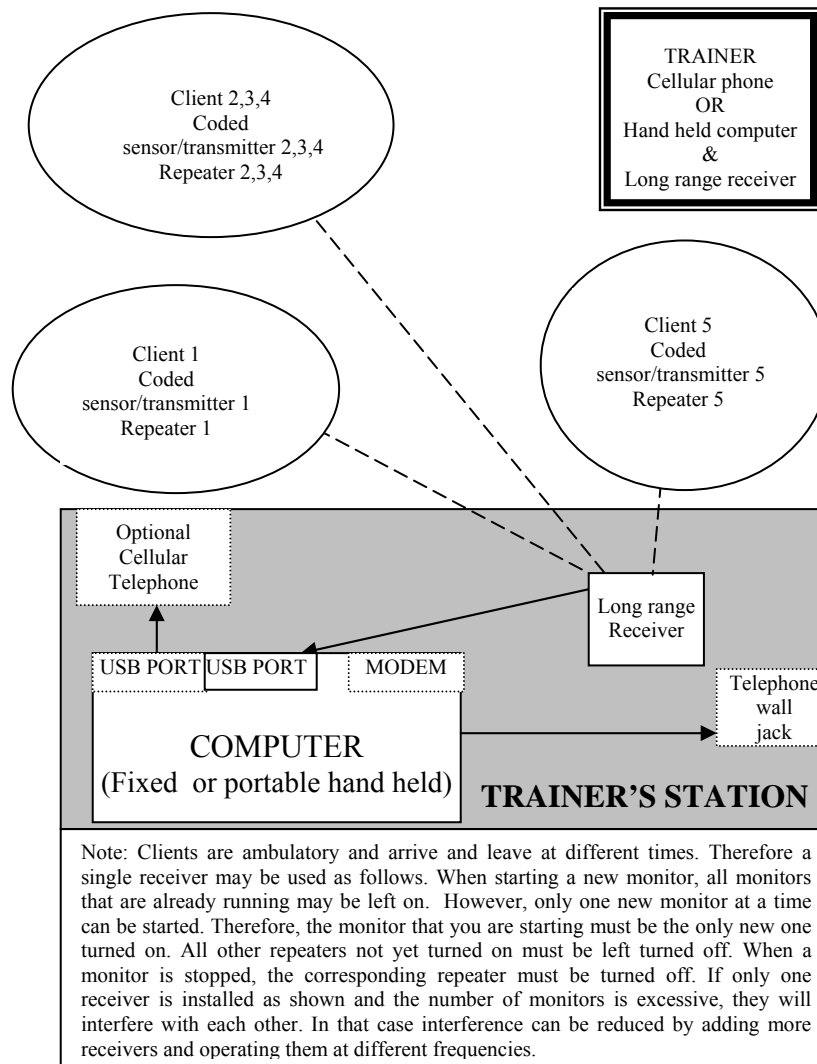
**LONG RANGE
COMPUTER-POWERED WIRELESS ULTRA-
INTELLIGENT REAL-TIME MONITOR
SINGLE HOME USER**

Home adult user can move about inside and outside of home completely free of wires.
If the computer is portable & powered by a motor car battery, then travel is possible
(e.g. shopping, picnic, etc.).



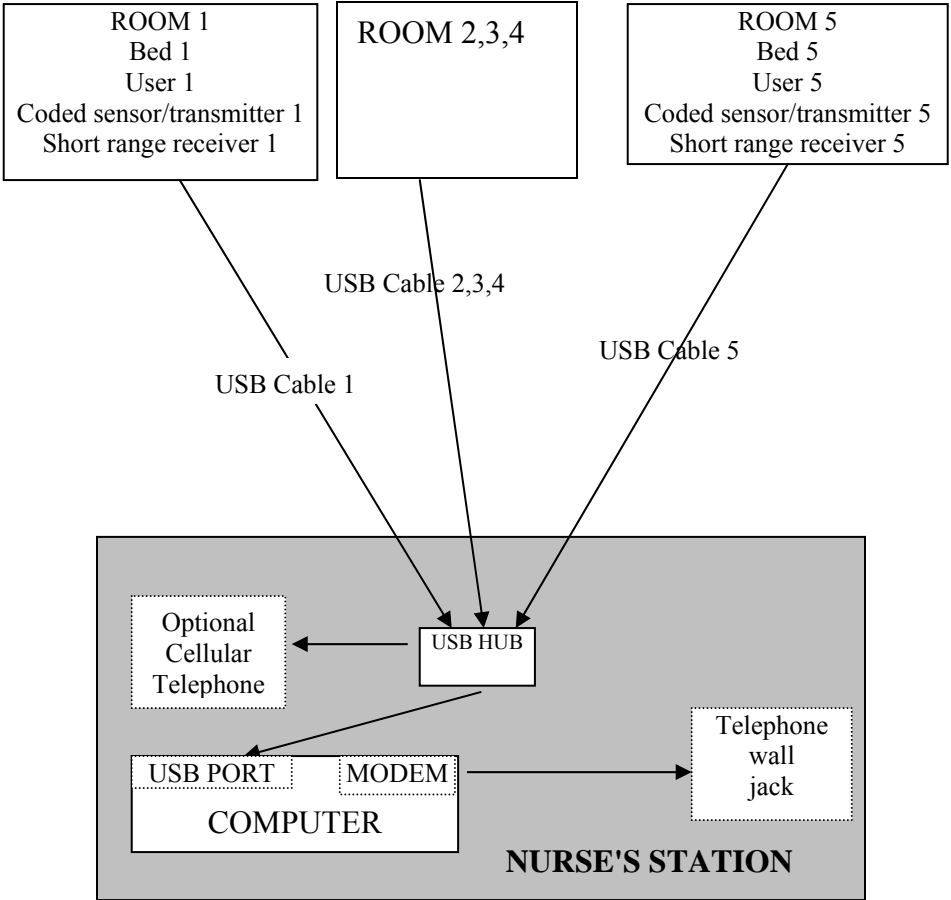
LONG RANGE COMPUTER-POWERED WIRELESS ULTRA- INTELLIGENT REAL-TIME MONITOR GYMNASIUM

Clients can move about (at least 3ft apart from each other) completely free of wires.



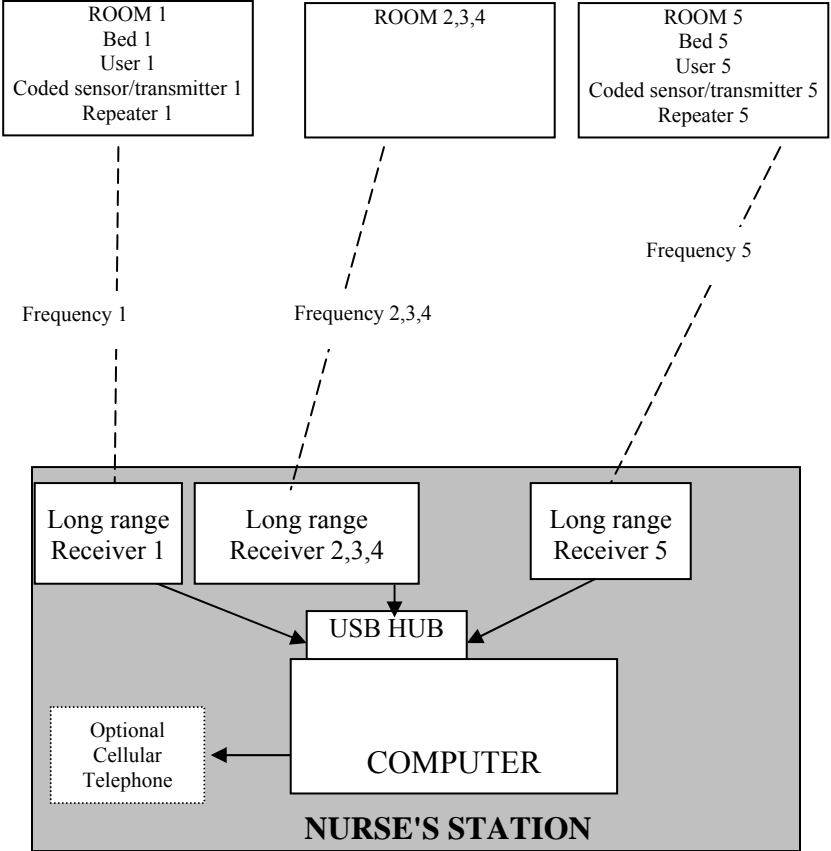
**SHORT RANGE
COMPUTER-POWERED WIRELESS ULTRA-
INTELLIGENT REAL-TIME MONITOR
HOSPITAL or NURSING HOME**

Users are lying down (at least 3ft apart) but can adjust their body position completely free of wires.



**LONG RANGE
COMPUTER-POWERED WIRELESS ULTRA-
INTELLIGENT REAL-TIME MONITOR
HOSPITAL or NURSING HOME**

Users can lie down, sit up, or walk about (at least 3 ft apart from each other) completely free of wires.



Appendix A

Actual values & Standard Deviations

Standard deviation is a measure of dispersal or amount of variation amongst a set of numbers. A low standard deviation indicates that the numbers are close to each other. A high standard deviation indicates that the numbers differ greatly.

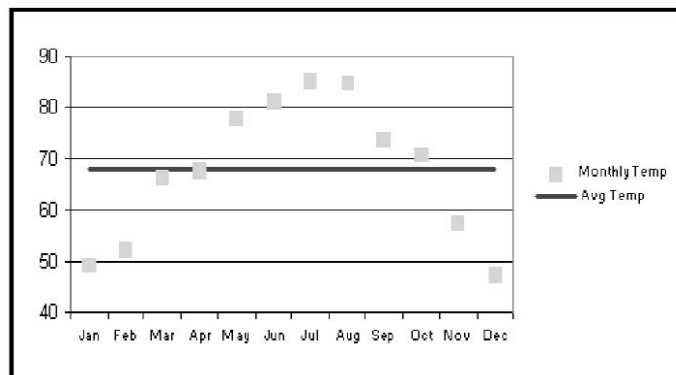
The CWURM monitor displays a data chart in terms of actual values and a standard deviation chart in terms of standard deviations. These charts are explained below.

Actual values

The chart of actual values is customized to the category in which the person being monitored falls. The upper and lower alarm limits are for the category (not the individual person). However, even within a category, one size does not fit all. A person who exercises regularly may have a relatively strong heart that pumps more blood with each heart beat. In that case the normal heart rate is relatively low, and may be lower than the lower alarm limit. Conversely, a sedentary person may have a relatively weak heart that pumps less blood with each heart beat. In that case the normal heart rate is relatively high, and may be higher than the upper alarm limit.

Standardized values

The chart of standardized values is customized to the individual person being monitored. The upper and lower alarm limits are for the individual person (not their category). The unit of measure on the standardized chart is standard deviations. The standardized chart will detect a relatively large sudden increase or decrease in a data value, even if the data value is normal for the designated category.



Appendix B

Frequency Switches

Frequency Switches are mechanical devices used to change the modulation of information via electrical signals. They are used to set the frequency on the CWURM repeater and long range receiver to enable them to communicate with each other. The switches may also be used to change the operating frequency so as to avoid interference from other devices.

The CWURM repeater and long range receiver have three frequency setting switches each. There are $2^3=8$ possible settings for the frequency switches as demonstrated below.

	Setting #1	Setting #2	Setting #3	Setting #4
SWITCH position	1 2 3 Off Off Off	1 2 3 On Off Off	1 2 3 On On Off	1 2 3 On Off On
	Setting #5	Setting #6	Setting #7	Setting #8
SWITCH position	1 2 3 Off On Off	1 2 3 Off Off On	1 2 3 Off On On	1 2 3 On On On

Appendix C

Pre-selected Default Settings for User Age & Sex

The pre-selected default settings for age range and sex are only for those users who are at rest, sitting down, or sleeping. If the person being monitored will be walking around or exercising, their pulse will normally rise far above their resting pulse rate. In this case, select Walk About Mode. This will prevent excessive false alarms from occurring. The lower pulse limit will be set to 50 bpm, but there will be no effective upper limit. An alarm will still be activated if there is a sudden, large increase or decrease in pulse rate (greater than the preset limits on the standard deviation chart.)

The pre-selected default settings are based on nationally published resting heart rate ranges for the following age ranges and sex (references 6,7).

Age Group	Sex	Resting Heart Rate Range
Newborn	M & F	70 to 170 bpm
1 to 2 Years	M & F	80 to 130 bpm
2 to 4 Years	M & F	80 to 120 bpm
4 to 6 Years	M & F	75 to 115 bpm
6 to 10 Years	M & F	70 to 110 bpm
10 to 12 Years	M	65 to 105 bpm
10 to 12 Years	F	70 to 110 bpm
12 to 14 Years	M	60 to 100 bpm
12 to 14 Years	F	65 to 105 bpm
14 to 16 Years	M	55 to 95 bpm
14 to 16 Years	F	60 to 100 bpm
Over 16 Years	M	50 to 90 bpm
Over 16 Years	F	55 to 95 bpm

Appendix D

Deactivating Screen Savers and Automatic Power Shut Down Options

It is imperative that you turn off all screen savers and deactivate sleep mode, hibernate mode and any other automatic power shut down options.

To assist in this process use the Display and Power controls Icon to launch the display properties window.

NOTE: Certain screens appear differently depending on the particular operating systems and computer. This sample screen is one example of the display properties for a laptop running Windows XP.



To Turn Off Your Screen Saver:



1- Select the "POWER" button.



2- Select the appropriate setting to disable all power down options. button.

Glossary of Terms

Arrhythmia – A change in the regular heart beat. The heart may, skip a beat, beat irregularly, or beat very fast or slow.

Automatic Phone Alarm– Automatically dials user-specified phone numbers in the event that any chart of the person being monitored becomes red. A chart will turn red after three consecutive breaches of the user specified limits.

Automatic Print Alarm– Automatically prints charts in the event that any chart of the person being monitored is red for a user specified time. A chart will turn red after three consecutive breaches of the user specified limits.

Baud Rate– Baud rate is a measure of the number of times per second a signal in a communications channel changes state.

Breach– Any heart rate activity in excess of user-specified control limits.

Caregiver– A person who is responsible for attending for the needs of a child or a dependent adult.

Common Cause– Vital signs response associated with internal biological effects.

External Cause– An event that is triggered by something outside the body.

Frequency Switch – Mechanical device used to modulate the flow of information via electrical signals.

Internal Cause– An event that is triggered by something inside the body.

Local Phone Number– Phone number dialed if any chart becomes red.

Modem – A device or program that enables a computer to transmit data over, for example, telephone or cable lines.

Modem COM Port– A signal input (access) or output cable point for a modem on your computer.

Password – A form of authentication which uses secret data to control access to a resource. The password should be kept secret from those not allowed access.

Polar® Heart Rate Transmitter– A wireless chest strap transmitter that detects heart rate EKG accurately from a user's chest, and sends this information to the CWURM receiver.

Profile– A subset of information that is used as a unique identifier for an individual.

Real-time– A level of computer responsiveness that allows a user to access information almost immediately.

Remote Phone Number– Phone number dialed if any chart remains red for a user specified period of time.

Session– A period of time devoted specifically to heart rate monitoring.

Special Cause– Vital signs response associated with external environmental effects

Standard Deviation – Measures the dispersal, or variation in a group of numbers. It represents how tightly a set of values is clustered around the average of those same values. (See also Appendix A.)

CWURM Heart Monitoring System– A low-cost alternative for monitoring vital signs in order to help reduce the number of unnecessary heart-related tragedies in the average household, in hospitals, and in nursing homes. CWURM also serves as a mobile and fully integrated heart monitoring system to help in the analysis of fitness, performance, and health for the active adult.

CWURM Receiver – Wireless device which receives heart rate information from the transmitter, and feeds the heart rate information into a personal computer ..

CWURM Signal Repeater – Receives heart rate information from the transmitter and re-transmits the heart rate information to the CWURM Long Range Receiver

Threshold– The point that must be exceeded to begin producing a given effect or result; or to elicit a specific response.

USB (Universal Serial Bus) Port– An external interface signal input (access) or output cable point for communication between a computer and peripheral.

USB Cable– An electrical conductor used to connect a USB cable point in the computer to the external peripheral.

Walk About Mode– The lower pulse limit will be set to 50 bpm, with no effective upper pulse limit. An alarm will still be activated if there is a sudden, large increase or decrease in pulse rate (greater than the preset limits on the standard deviation chart.)

Trouble Shooting

No data or chart appears on the screen

Causes:

The chest strap battery has expired (the battery life is about 2500 hours).

The chest strap electrodes require moistening.

The short range monitor receiver is less than 1 foot from the computer.

The USB drivers for the receiver are not installed.

The USB port number assigned in the customize menu is not correct.

The repeater battery requires recharging (long range monitor only).

The repeater is turned off.

The repeater is more than 3 feet from the chest strap.

The repeater is less than 1 foot from the computer or other interference generating electrical equipment.

The receiver is not plugged in.

The repeater and receiver frequency switch settings do not match.

The repeater is more than 1000 feet from the receiver.

The monitor is experiencing interference at the particular frequency to which it is set (on the repeater & receiver). The frequency settings must be changed.

Chart has stopped updating.

Causes: The chest strap was temporarily removed and replaced, and the transmission code changed. The monitor must be restarted.

Repeater LED does not blink

Causes: The repeater requires recharging.

Repeater LED blinks every 5 seconds not with every heart beat

Causes: The repeater is more than 3 feet from the chest strap or the strap needs moistening or a new battery. The battery life is about 2500 hours.

Repeater battery does not hold charge

Causes:

Battery was left discharged for an extended period. Place the repeater on a 24 hour slow charge (switch turned OFF). If that fails, the battery is damaged.

Battery is damaged or has expired. A damaged battery can result from storage in a state of discharge. Also, the battery will expire after about 1000 recharges or about 2 years of use.

Telephone alarm does not work.

Causes: The port number for the modem to which the telephone is connected is not correct. Correct the port settings and test the telephone connection and number from the customize screen.

References

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6. Kosier, B. & Erb, G. "*Fundamentals of Nursing: Concepts and Procedures*. 2nd edition, Addison – Wesley, 1983.
7. Malasonas, L., Barkauskas, V., Moss, M. & Stoltenberg – Allen, K. *Health Assessment*, 2nd edition, The C.V. Mosby Co., 1981.
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WARNINGS and NOTICES

WARNING! The products to which these instructions apply rely on the proper operation of the user's computer, sound speaker, video screen, modem, telephone system, electrical power supply, other hardware and software at all times. Without any one of these components, the alarm systems will not operate. The user must inspect each of these items to ensure that they are operating correctly at all times.

WARNING! The program relies on the windows operating system provided by the user. The user must check the computer screen periodically (at least once every hour) to verify that the charts are being updated, and especially once per day when the operating system updates the date calendar.

WARNING! The monitor uses the computer's modem to execute the telephone alarm. The monitor can be used on a computer that is also being used by other applications. However, there must be no sharing of the same modem and/or telephone line. For example if the computer is being used to browse the internet via a single modem, the monitor's telephone alarm will not function because the modem will already be in use. In that case, a separate modem or other means of internet connection must be used.

NOTICE

The products to which these instructions apply are recommended for the non-invasive measurement of biological vital signs. They display data on a computer screen and a printer, and will alarm when values fall outside a predetermined user specified range. They are not suggested or recommended for use in connection with any illness or health defect whatsoever. No medical interpretation or diagnosis is performed and no treatment or action whatsoever, medical or otherwise, is suggested or recommended. They will not prevent, treat or cure any illness. By using this reference monitor, the user accepts full and complete responsibility for the proper operation of the user's computer, sound speaker, video screen, modem, telephone system, electrical power supply, other hardware and software at all times, so as to alarm when biological vital signs data fall outside any predetermined user specified range. In case of illness consult a physician.

DISCLAIMER

The manufacturer of this product is continually striving to improve the quality and function of its products and services; for this reason, it reserves the right to make changes without notice. Specifications are based on representative lot samples. Values may vary from lot to lot and are not guaranteed. The manufacturer makes no guarantee, warranty, or representation regarding the suitability or legality of any product or service for use in a specific application. No device, product or service is intended for use in applications of a critical nature where the safety of life or property is at risk. The user assumes full liability for the use of the device, product or service in such applications. Under no circumstances will the manufacturer be responsible for losses arising from the use or failure of any device, product or service in any application, other than the repair, replacement, or refund limited to the original device, product or service purchase price. Some devices are patented. Under no circumstances shall any user be conveyed any license or right to use or ownership of these patents.

RADIO FREQUENCY

The long-range monitor described in this product contains a RF module that has been previously tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These 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 on and off, 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 the 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 equipment has been certified to comply with the limits for a Class B computing device, pursuant to FCC Rules. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

FCC ID: QU8FOURCAST

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 UNDESIRE OPERATION.

Model Number: FOURCAST



Tested To Comply
With FCC Standards

FOR HOME OR OFFICE USE