

## MAGENTA HEART RATE MONITOR FOR ZX SPECTRUM COMPUTER

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HEART RATE MONITOR UNIT

3M LEAD WITH 3.5MM JACK PLUGS

PROGRAM CASSETTE

LEAFLET

BATTERY FIXING TAPE

### INTRODUCTION

The heart rate monitor detects blood flow fluctuations in a finger placed over the sensor. Each time the heart beats a large fluctuation in blood flow occurs. These fluctuations are converted into an electronic signal which the computer reads via its "EAR" socket.

In the computer a special machine code routine working in "real time" counts a preset number of beats, & then returns to BASIC. On return to BASIC the machine code program carries a number corresponding to the time taken for the number of beats counted. From this information the heart rate is calculated & displayed.

### PROGRAMS

There are two programs, the first (program 1) displays a digital readout of the heart rate. The second (program 2) produces a bar chart of consecutive heart rate readings.

### LOADING

The programs are loaded in the normal way.

SIDE 1 OF THE CASSETTE IS FOR 16K MACHINES

To enter program 1 type: LOAD "HEART 16"

To enter program 2 type: LOAD "HEART 16/2"

SIDE 2 OF THE CASSETTE IS FOR 48K MACHINES

To enter program 1 type: LOAD "HEART 48"

To enter program 2 type: LOAD "HEART 48/2"

Both programs load their own machine code, & then prompt for starting values.

The 16k program will run on both the 16K & 48K machines. The 48K program will run on only the 48K version.

#### SETTING UP & USE

The heart rate monitor is powered by a PP3 9V battery. To insert the battery, remove the four cover fixing screws, connect the battery clip, & stick the battery to the end wall of the case using one of the sticky pads provided. Refit the cover taking care not to overtighten the screws.

Link the computer "EAR" socket to the heart rate monitor using the 3m lead supplied. It is not necessary to have a program loaded into the computer at this stage.

NOTE: the heart rate monitor socket also acts as the on/off switch - make sure you remove the plug whenever the unit is not in use.

As soon as the connection has been made to the computer, an intermittent beeping sound should be heard from the computer's speaker. Place the middle finger of one hand centrally on the sensor. It is important to keep the finger still & relaxed to get a good reading - the correct pressure is not critical, & can be found by trial & error. After a few seconds the sensor adjusts itself and a steady beep - beep sound should be heard. Check that each beep corresponds to a heart beat by feeling the pulse in the wrist or neck.

Whilst the equipment is set up in its present form it is worthwhile experimenting with the sensor. It should be possible to pick up a good signal from the thumb, fingers, cheek & earlobe.

Disconnect the sensor & load one of the programs.

The operation of each program is straight forward if the prompts are correctly followed. It is wise to start by timing 3 beats as this gives a good compromise between speed & accuracy. To break out from the programs it is necessary to catch the computer with a "BREAK" command whilst it is executing the BASIC part of the program. The machine code routine ignores the keyboard completely, & returns to BASIC only when the full number of beats has been counted.

## PROGRAMMING

The two programs supplied are written in straightforward BASIC & are listable so that they may be customised by the user.

The machine code routines are located above RAMTOP at:-

32468 - 32518 - 16K

65236 - 65286 - 48K

In each case "RAMTOP" has been reduced to leave space for the routine.

32467 - 16K

65235 - 48K

The number of beats to be counted is set by POKEing location 32502 (16K) - 65270 (48K) with a number between 1 & 255.

To use the routine simply use the expression USR 32468 (or 65236 for 48K).

The result is the number of 50ths of a second which have passed whilst the set number of beats has been counted. Line 510 in the /2 program shows how to convert this number to beats per minute.

As the machine code is above RAMTOP the computer can be cleared by typing "NEW" without losing the code. To load just the machine code directly from tape type:-

LOAD "HEART 16" CODE

or LOAD "HEART 48" CODE , as appropriate.

## ACCURACY

Providing the sensor is correctly positioned, so that every heart beat is picked up, the accuracy of reading is dependent upon the resolution of the computer.

Each group of beats is timed against the quartz accurate 50Hz "FRAMES" counter in the computer. If just one beat is counted "FRAMES" will count up to approximately 50 each time. This will return a heart rate of 60. If the rate increases slightly the next lower count can only be 49. This means a 2% drop in the indicated rate even though the actual rate may have fallen by only 1%. This situation represents the worst case & assumes that a useful heart rate reading can be obtained from 1 beat. In practice a single beat can be totally unrepresentative of the true rate, so that even 2% computer error is totally insignificant. As soon as a longer group of beats is timed the resolution & accuracy increase substantially. Taking 6 beats as an example "FRAMES" will count to 300 or 299 etc - a 1 in 300 resolution, or 0.33%. Above this the accuracy continues to increase way above the needs of normal monitoring.

## GENERAL NOTES

The heart rate monitor sensor unit may be used without the computer through an amplifier where a simple ECG type output is required. It is also possible to record the beeps on a portable recorder & replay them into a computer for later analysis at leisure.

## BATTERY LIFE

The electronic signal processing uses the latest low power techniques to minimise current consumption. Using a standard PP3 battery 72 hours continuous use should be expected. An alkaline PP3 is recommended where very heavy use is anticipated.

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