



User Manual

GENEA

for
Software version 449

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C7931-R-002 v0.4
20 March 2008

Subject: User Manual

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1 The GENE A quick guide

(Gravity Estimator of Normal Everyday Activity)

The main component blocks in GENE A are: a three axis accelerometer, a microprocessor, a very big memory (0.5G byte) and a lithium battery. In addition there is a hidden LED and a Capacitive Touch Switch.

The GENE A communicates to, and charges its battery from, the PC via a mini USB lead. So that you can continue with your first 'play' we should ensure the battery is charged. Simply remove the GENE A strap and the stainless steel cover to expose the mini USB connector. Now connect it to any free USB port on the PC. The GENE A should flash its LED once every 5 seconds to indicate that it is connected. (Note – If the GENE A battery is well discharged it may take some minutes before the PC recognises that it is connected.)

There are two PC applications that set up and control the GENE A. The first - GENE A_Data is the main application you will use for normal operations. The second - GENE A_Maintenance allows you to check and change some internal settings. Don't fiddle unless you know the rules!

1.1 Install the PC software

Copy the three files from the CD into your chosen directory you have created on the hard disk. These files are:

GENE A_Data.exe
GENE A_Maintenance.exe
mchpcdc.inf

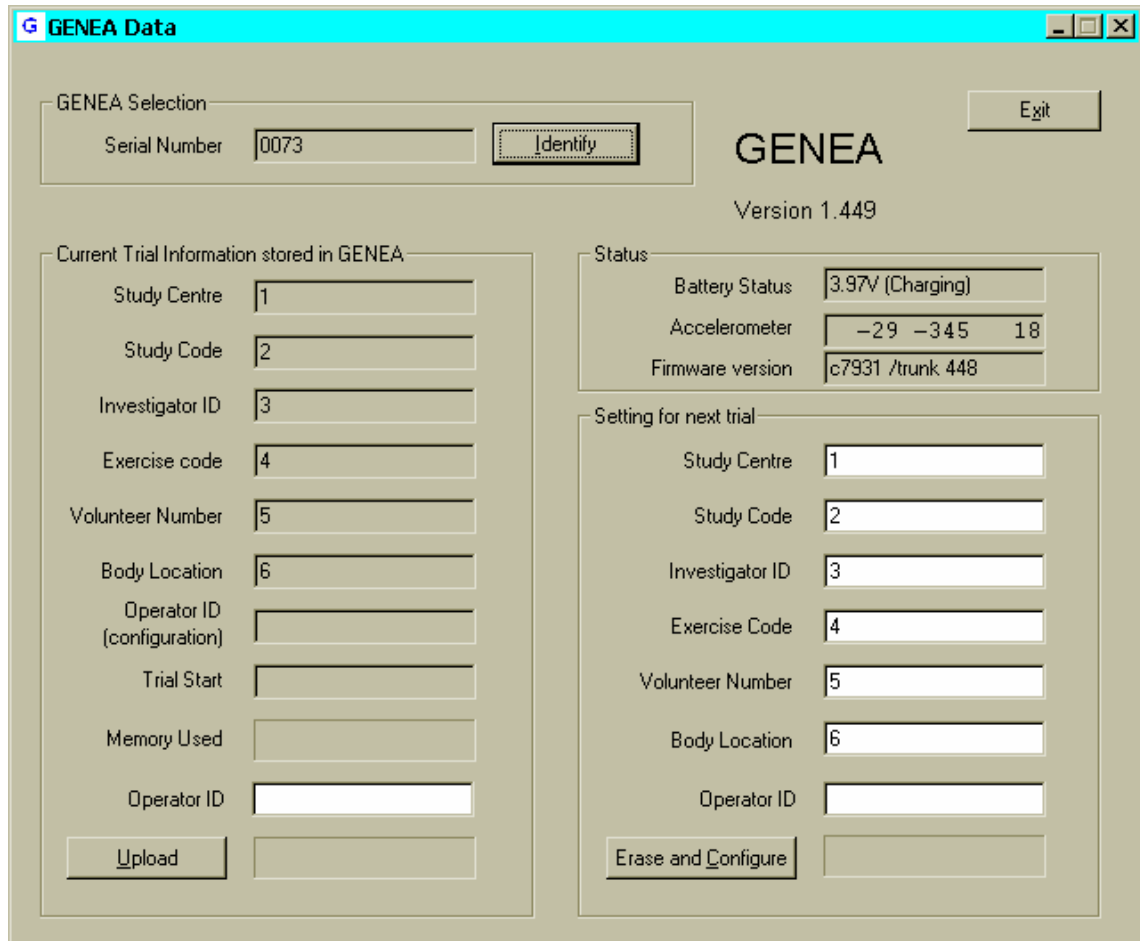
Install the USB port driver

1. The window 'Found New Hardware Wizard' should have popped-up when the GENE A was connected.
2. Click the button 'Install from a list of specific location'
3. In the next window check the box 'Include this location in the search' and then browse to the directory where you have copied the three files to. Click Next
4. In the next pop-up window warning about installing hardware click 'Continue Anyway'
5. Click 'Finish' in the original window.
6. The GENE A USB port driver is now installed.

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1.2 Collect your first activity data

Before GENEa can collect data it must be Erased & Configured. Open the PC application GENEa_Data



GENEA Data [Exit]

GENEA
Version 1.449

GENEA Selection

Serial Number: 0073 [Identify]

Current Trial Information stored in GENEa

Study Centre: 1
Study Code: 2
Investigator ID: 3
Exercise code: 4
Volunteer Number: 5
Body Location: 6
Operator ID (configuration):
Trial Start:
Memory Used:
Operator ID:
[Upload]

Status

Battery Status: 3.97V (Charging)
Accelerometer: -29 -345 18
Firmware version: c7931 /trunk 448

Setting for next trial

Study Centre: 1
Study Code: 2
Investigator ID: 3
Exercise Code: 4
Volunteer Number: 5
Body Location: 6
Operator ID:
[Erase and Configure]

You should see your GENEa's serial number in the top left sub window 'GENEA Selection' (in this example it is 0073). In the right sub window 'Status' you should see the Battery Voltage and Accelerometer readings slowly changing.

(The entries in the remaining windows are 'left-overs' from acceptance testing and can be ignored.)

For your first test just click the button "Erase and Configure" and wait for the progress bar to announce 'DONE'. Now, provided the battery voltage is above 3.7V you can disconnect GENEa from the PC (simply pull out the mini USB lead).

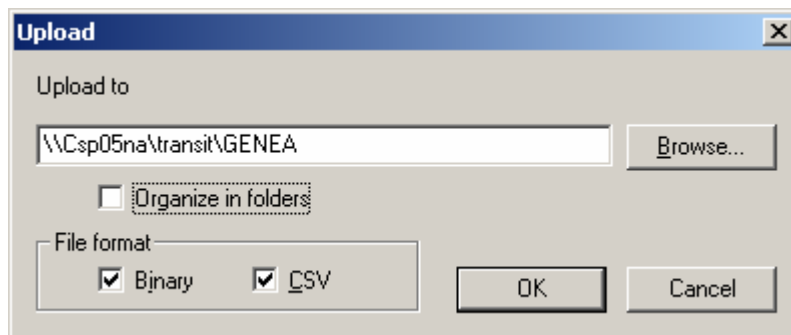
The GENEa is now in a 'Snoozing' state waiting for you to start your trial. To start the GENEa data collection, tap the Capacitive Touch Switch (recessed area on case) until the LED starts to flash. Once the LED flashing starts HOLD your figure firmly ON

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until the LED goes solid on and then off (about 3 seconds). If you were successful in starting the data collection mode the LED will respond with 4 rapid flashes.

Now ‘Dance and swing’ with GENEa and all your movements will be recorded. Data collection will continue until the battery is flat or you initiate an **UPLOAD** of data (using the application GENEa_Data) to the PC. Lets not be too ambitious in the first trial so re-connect to the PC (plug-in the mini USB) and the PC application should re-activate itself. (At this point GENEa is still collecting data!)

To stop the data collection, click the button ‘**UPLOAD**’(in the GENEa_Data application). This will open a second message window ‘Upload’.



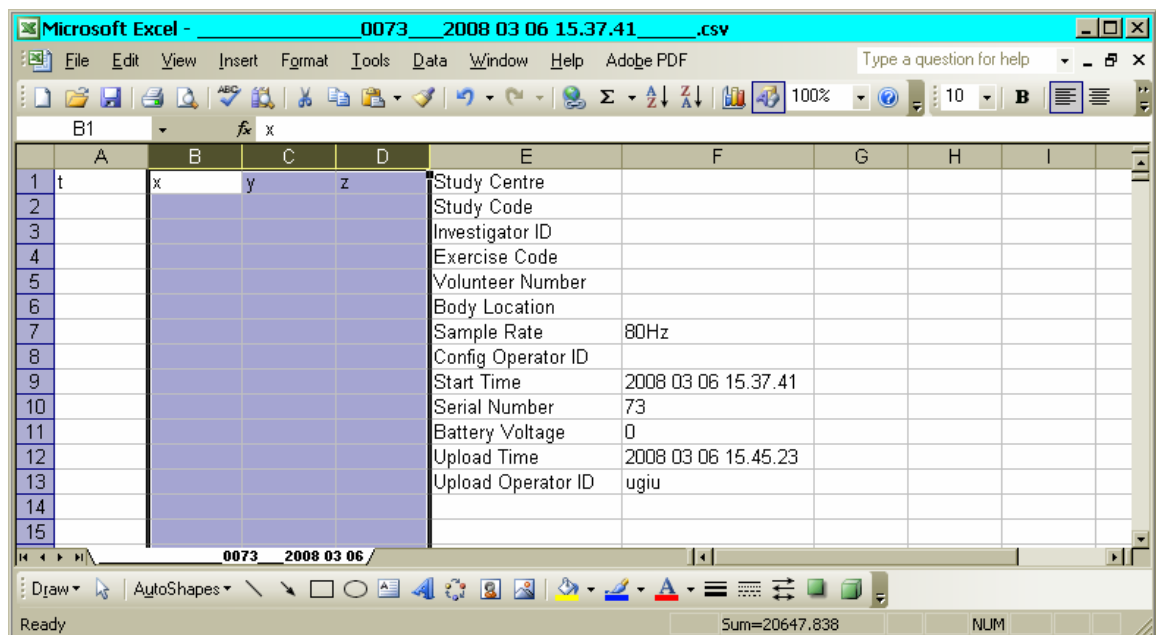
In the middle of the window **UNCHECK** the tick box ‘Organise in folders’ and ensure that the tick box ‘CSV’ is checked. Then click **OK**. Wait for the progress bar to announce ‘**DONE**’.

1.3 View your activity data

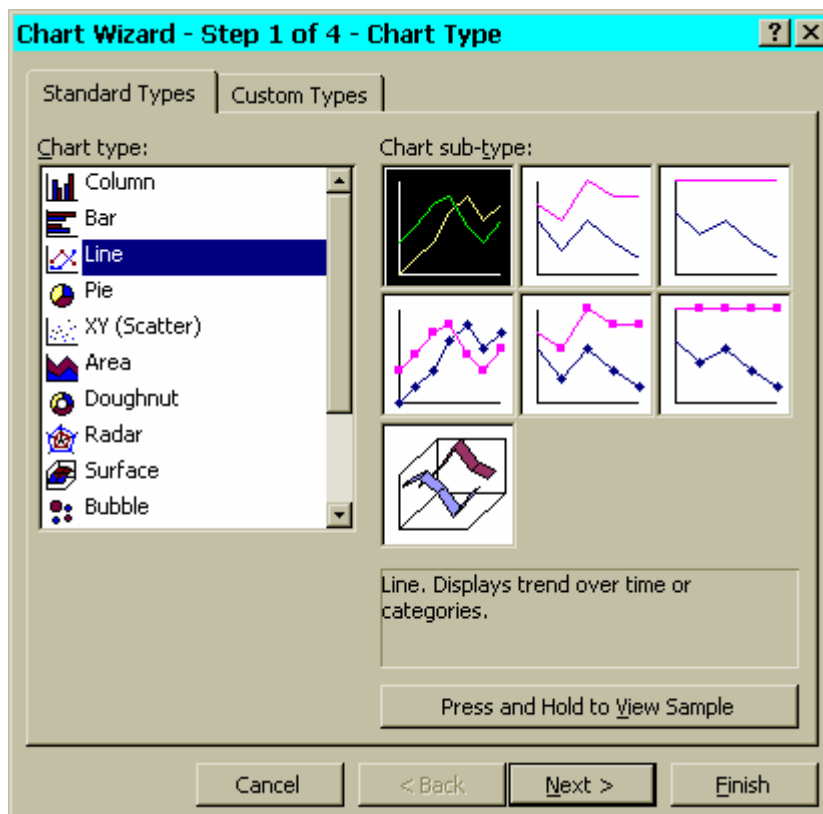
Use EXCEL – ‘File Open’ and locate the directory where you installed the GENEa_Data application and select the file. In this example it will be ‘_____0073____2008 03 06 15.37.41____.csv’.

Select columns B, C, D and plot. (don’t worry that you can’t see the data, it starts at line 100 but by simply selecting the entire column this is sorted for you).

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Use the Plot function select 'Line' (without markers)



You should now see you activity data.

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2 GENE Detail

Once the GENE has been Erased & Configured and disconnected from the PC it is in 'Snoozing' state. While in this state it keeps a record of 'real time' as set by the PC clock ready for putting 'time stamps' against the activity data when the recording mode is activated.

2.1 The Capacitive Touch Switch

The Capacitive Touch Switch has two functions:

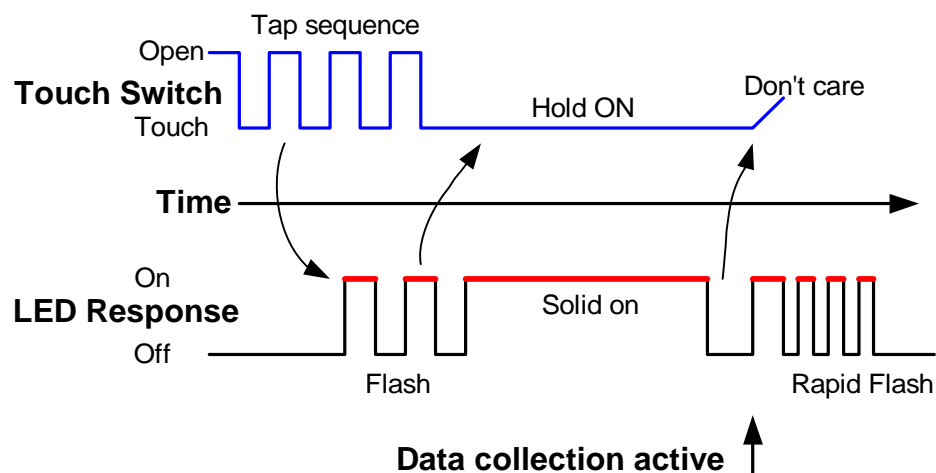
1. To let the User check that GENE is still working
2. Activate Data Collection

To prevent accidental operation of the switch it must be tapped several times, at approximately twice per second. Once the tap sequence is detected the LED will start to flash.

- For switch function 1- stop tapping as soon as the LED flashing starts. This has simply confirmed that GENE is still functional
- For switch function 2 - as soon as the LED flashing start firmly hold your finger ON and wait for the LED to go solid for 2 seconds and then off. You can now remove your finger from the switch. GENE is now active and collecting data and reports its new state by giving 4 rapid flashes.

Once the data collection is started you cannot stop it by tapping the switch. If you want to confirm that the 'Data Collection' is active simply tap for switch function 2 (ie tap and hold) and GENE will respond with an extra set of 4 rapid flashes.

The time diagram below shows the relationship between Capacitive Touch Switch tapping and the LED response to move from the Snooze state to the Data Collection state.



N.B. The 4 rapid flashes at the end confirm the Data Collection is active

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2.2 The LED

The LED displays various messages to the User.

Your Action or Inquiry		Flash sequence
Connected to USB port and charging the battery (the PC application is not running)		Short flash every 5 seconds
Connected to USB port and the battery is fully charged (the PC application is not running)		Longer flash every 5 seconds
Connected to USB port and the PC application is running		Continuous 0.5 second flash
Disconnect GENE A from USB after a correct Erase and Configure procedure		None or no significance flash
Disconnect GENE A from USB after a correct Erase and Configure procedure BUT the Battery Voltage is low		Rapid flash (2 flashes per second)
Disconnect GENE A from USB but has not been Erased and Configured correctly <i>If you have simply wanted to charge the battery then the message is a reminder</i> The Panic flash takes precedence over all other LED actions. If a Panic flash occurs you must reconnect and 'Erase and Configure' before a Data Collection can be started		Panic Flash Rapid flashes for 20 seconds after USB disconnected.
To start a Data Collection (see section 2.1 above) (ie tap and hold) Note – If the final 4 flashes do not appear it has NOT move to the Data Collection mode		Flashes 2 seconds solid on 4 Flashes
To confirm a Data Collection is active (see section 2.1 above) (ie tap and hold)		Flashes 2 seconds solid on 4 Flashes
To check the Battery Status while a Data Collection is active. Tap the switch until the LED starts to flash. Stop tapping	For Battery voltage above 3.6V	4 Flashes and then stops
	For Battery voltage below 3.6V. This low threshold is programmable	4 Flashes then after a 4 second delay LED flashes a double flash, three times.

2.3 Data Collection Run Time

GENEA has sufficient battery capacity to collect data for about 8 days at the 80 samples per second rate. The longer the GENE A is in the 'Snooze' state the shorter the data collection period will be.

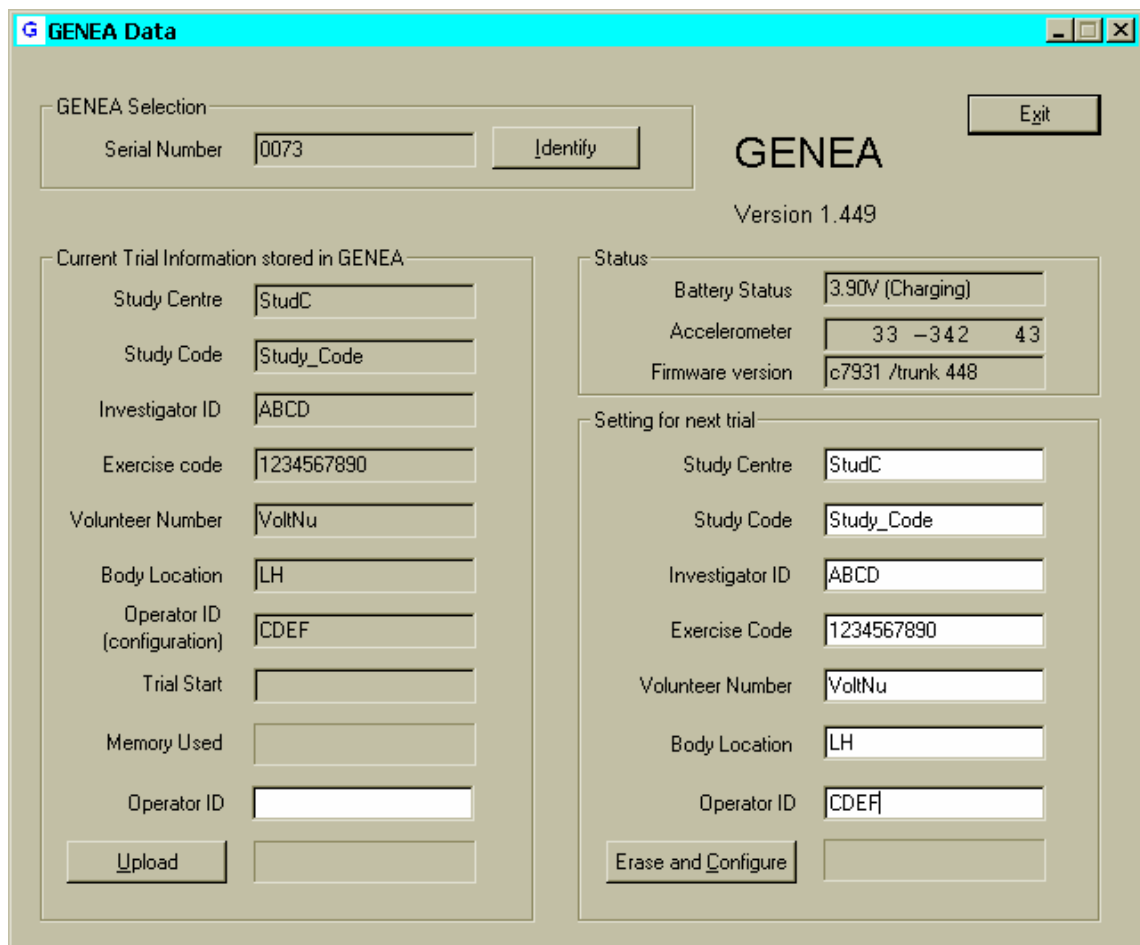
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2.4 The Battery Status

The battery measuring circuit is meant for indication only. The nominal battery voltage is 3.7V and fully charged it is greater than 4.1V.

If the battery voltage is below a predetermined threshold (3.6V) when the GENEa is disconnected from the USB it will cause the Low battery warning sequence.

3 The PC Application 'GENEA_Data'



GENEA Data

GENEA Selection

Serial Number: 0073 [Identify]

Exit

GENEA

Version 1.449

Current Trial Information stored in GENEa

Study Centre: StudC

Study Code: Study_Code

Investigator ID: ABCD

Exercise code: 1234567890

Volunteer Number: VoltNu

Body Location: LH

Operator ID (configuration): CDEF

Trial Start:

Memory Used:

Operator ID:

[Upload]

Status

Battery Status: 3.90V (Charging)

Accelerometer: 33 -342 43

Firmware version: c7931 /trunk 448

Setting for next trial

Study Centre: StudC

Study Code: Study_Code

Investigator ID: ABCD

Exercise Code: 1234567890

Volunteer Number: VoltNu

Body Location: LH

Operator ID: CDEF

[Erase and Configure]

A tour of the window

3.1 The sub box 'GENEA Selection'

When there is more than one GENEa connected to the PC it will allow you to select the GENEa you wish to configure or upload. Currently it shows the GENEa serial number and allows you to 'Identify' which GENEa is active. Using the mouse, Click and hold 'Identify' button and the GENEa LED will come on solid for 3 seconds.

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3.2 The sub box 'Status'

This shows some of the internal status of GENE. Basically it allows you to see the Battery Voltage and the activity of the Accelerometer (order X, Y, Z). In this window a reading of 340 corresponds to an acceleration of 1g.

3.3 The sub box 'Settings for next trial'

To save the possibility of human error all trial set-up parameters are stored in the GENE memory along with the actual trial data collected. Therefore before a trial can be started the GENE must be 'Erased and Configured'. The following fields are available to automatically structure the data filing on the upload to the hard disk.

It is optional if you make any entries in these fields but all these parameters are stored in the trial log along with the trial data. Each field has a limited number of characters available to restrict the overall length of the concatenated file and directory string. If a field is left blank or there are unused characters the rest of the field is padded with underscore characters.

Prompt	Field length	Use
Study Centre	5	Where are you located
Study Code	10	What are you doing
Investigator ID	4	Who is in overall charge
Exercise Code	10	What exercise are they doing
Volunteer Number	6	Who is doing the exercise
Body Location	2	Where on the body is GENE
Operator ID	4	Who is doing the typing

The button 'Erase and Configure' copies the contents of the fields into GENE's memory and activates the 'Snooze' state.

If a warning box appears stating 'Configuration could not complete' the most probable cause is a low battery voltage. Simple let the Battery charge.

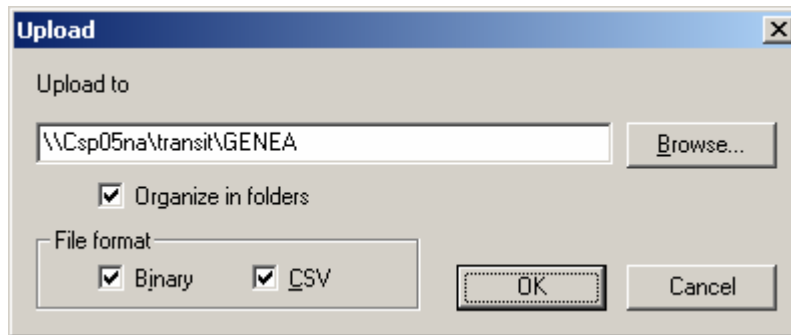
Note – Only use characters valid for directory names and filenames in the fields. The use of non standard characters (eg :) will result in data still being stored in GENE but you may need assistance to recover it!

3.4 The sub box 'Current Trial Information stored in GENE'

When GENE is connected to the USB the stored trial information is read from GENE memory into these non editable fields and also copied into the 'Setting for next trial' fields. (The exception is the 'Operator ID configuration' as they may have changed.)

The only field for you to fill in is the Operator ID for upload (field length 4 characters) The button 'Upload' will open a second message box 'Upload'

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The Upload message box allows you to change the location of the stored files and the saved file format. **YOU CANNOT CHANGE THE FILE NAME** even though it appears to offer the option.

If the tick box 'Organise in folders' is checked the following default sub-directory and file name format is used:

First sub directory:	Study Centre
Next level sub directory:	Study Code
Next level sub directory:	Volunteer Number

The automatically generated file name is a concatenation of: Exercise number, Body location, Serial number, Start data and time, Investigator ID.

Giving us the following name from the above example:

\\StudC\\Study_Code\\VoltNu\\1234567890_LH_0073__2008 03 06 13.58.07_ABCD.csv

If the tick box 'Organise in folders' is UN-checked the file is stored in the current directory

Giving from the above example:

_____0073__2008 03 06 15.37.41_____.csv

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3.5 The Trial Log

In addition to the actual data being stored there is an Excel file 'GENEA_Trial_log.csv' generated in each sub directory. This file holds a list of all the up-loaded files in that sub directory and the trial set-up parameters used for each data collection.

Upload time	Study Centre	Study Code	Volunteer Number	File Name	File Type	Exercise Code
2008 03 06 13.59.42	StudC	Study_Code	VoltNu	1234567890_LH_0073__2008 03 06 13.58.07_ABCD	.csv	1234567890
2008 03 06 13.59.42	StudC	Study_Code	VoltNu	1234567890_LH_0073__2008 03 06 13.58.07_ABCD	.bin	1234567890

Body Location	Serial Number	Trial Start Time	Investigator Id	Config Operator ID	Upload Operator ID	Sample Rate	Battery Voltage
LH	73	2008 03 06 13.58.07	ABCD	Fred	John	80Hz	3.8
LH	73	2008 03 06 13.58.07	ABCD	Fred	John	80Hz	3.8

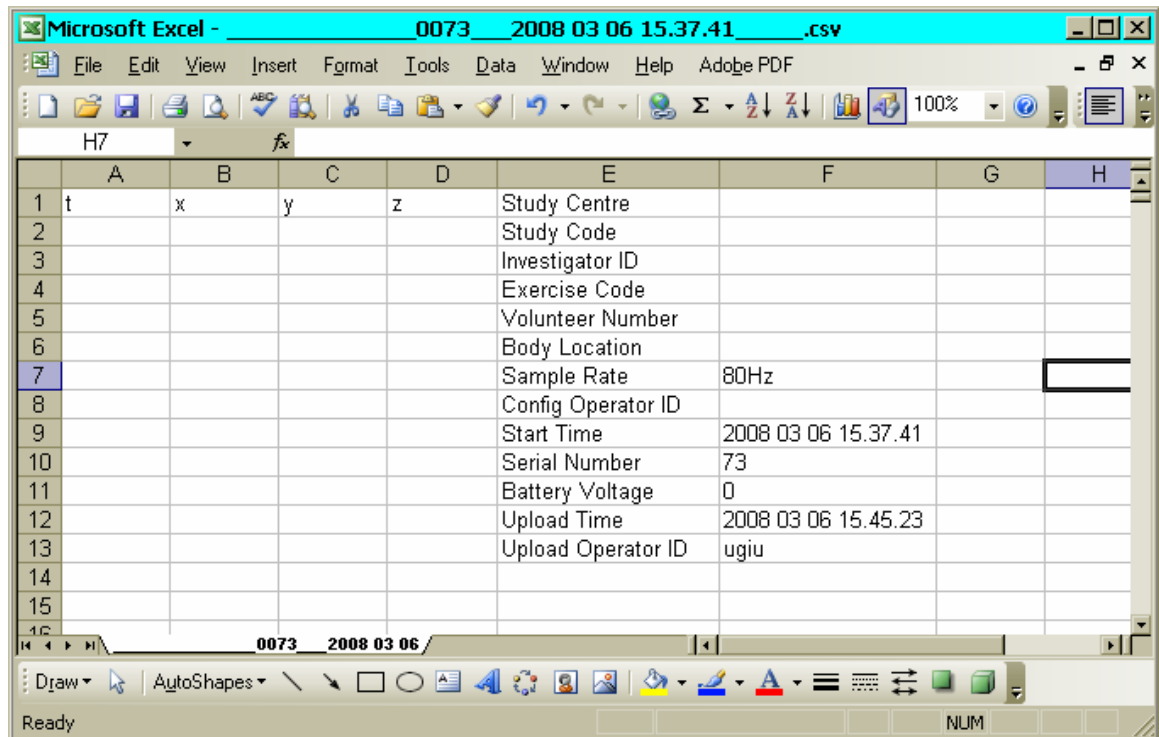
3.6 Upload File Formats

The Upload process can write the data files in a *.CSV format and a *.BIN format. The choice is made by checking the appropriate check box in the Upload message box.

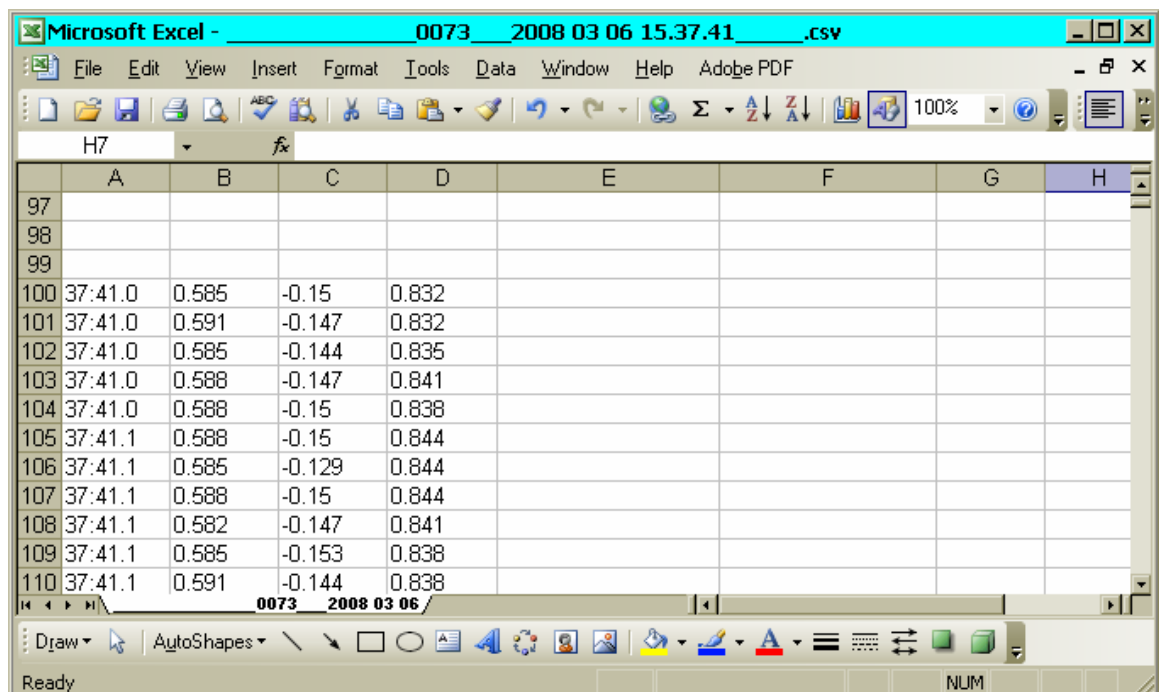
3.6.1 The CSV format

The *.csv file holds the trial set-up information and the collected data. The first 100 lines are reserved for trial set-up and any future diagnostic logs that we may wish to add to the file.

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The trial data starts at line 100



	A	B	C	D	E	F	G	H
97								
98								
99								
100	37:41.0	0.585	-0.15	0.832				
101	37:41.0	0.591	-0.147	0.832				
102	37:41.0	0.585	-0.144	0.835				
103	37:41.0	0.588	-0.147	0.841				
104	37:41.0	0.588	-0.15	0.838				
105	37:41.1	0.588	-0.15	0.844				
106	37:41.1	0.585	-0.129	0.844				
107	37:41.1	0.588	-0.15	0.844				
108	37:41.1	0.582	-0.147	0.841				
109	37:41.1	0.585	-0.153	0.838				
110	37:41.1	0.591	-0.144	0.838				

Note - Excel can only read in 65536 lines of data. At 80 samples per second this is only 13 minutes of activity.

The Acceleration data is scaled in g

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3.6.2 The *BIN* format

The *.bin file holds the trial set-up information, accelerometer calibration constants and the collected data in a raw format.

The Matlab script 'binread.m' will process the data and produce three output arrays

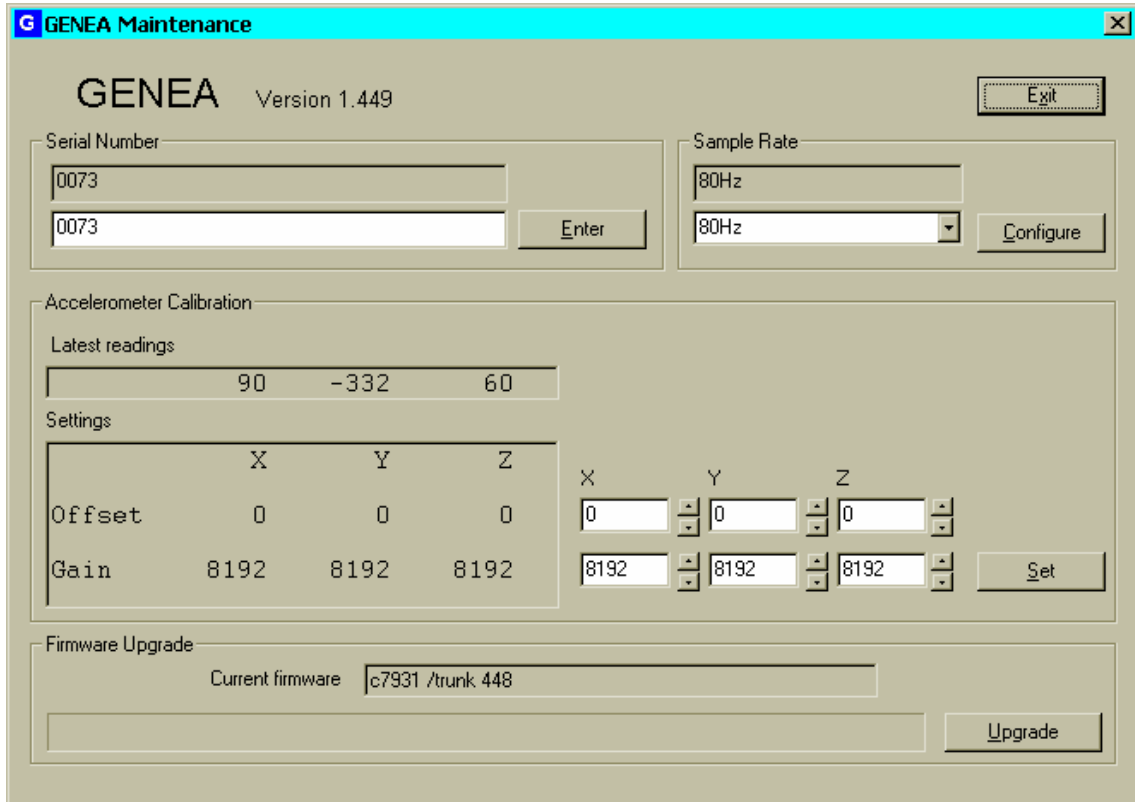
- Calibrated xyz data

- Battery voltage

- Time stamps

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4 PC Application 'GENEA_Maintenance'



GENEA Maintenance Version 1.449

Serial Number: 0073
0073

Sample Rate: 80Hz
80Hz

Accelerometer Calibration

Latest readings: 90 -332 60

Settings:

	X	Y	Z
Offset	0	0	0
Gain	8192	8192	8192

X: 0 Y: 0 Z: 0
8192 8192 8192

Firmware Upgrade

Current firmware: c7931 /trunk 448

This application is not intended for casual users.

A tour of the window

4.1 The sub box 'Serial Number'

This allows you to change the GENE serial number

4.2 The sub box 'Sample Rate'

If you want to collect data for more than 7 days you could reduce the sample rate to 40 samples per second. At this rate you could expect to collect for 10 days before the battery is discharges.

4.3 The sub box 'Accelerometer Calibration'

This allows you to change the Gain and Offsets of each axis of the accelerometer. The calibration is set for $1g = 340$ counts.

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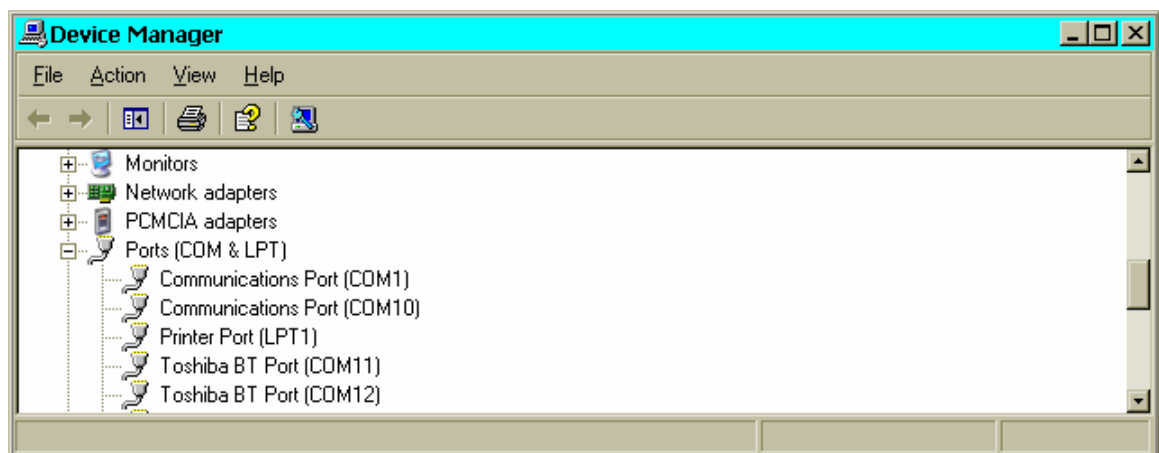
4.4 The sub box 'Firmware Upgrade'

It is possible to upgrade the GENE A firmware via the USB. Explicit instructions will be given when a new firmware version is issued.

5 Finger Troubles

5.1 During Installation

If the GENE A application does not respond after installation it is worth checking for contention in the Device Manager



Plug and unplug the USB lead and see which port is assigned to the GENE A application COM10 in this example. Make sure that it is unique number.

5.2 During Use

The software will not report if more than one GENE A application is open. The second one will not respond.