FGL Portable
Absolute Gravimeter

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Introduction

This manual explains the operation of Micro-g Solutions' (MGS) *g* Absolute Gravity Data Acquisition and Processing Software. The software operates in the Windows™ environment and is designed to replace the DOS-based Olivia software. *g* can be used with all MGS absolute gravimeters, including the FG-5, A-10, I-10 and FG-L gravimeters, and is capable of processing archived data collected with most Olivia versions[1].

The software package provides sophisticated data collection, processing and analysis capabilities including standard environmental gravity corrections necessary for μGal gravity measurements.   The software allows the user to customize the data acquisition program for each site including geodetic coordinates, delayed start-up, set and drop rate and other detailed site information.

g requires a binary security file that is unique to each individual system to operate.

g users familiar with previous version of *g*, Olivia, or absolute gravity data acquisition will find the software easy to use and operate. Those new to absolute gravity measurement should read this operation manual carefully before operating any MGS absolute gravimeter or post-processing any absolute gravity data.

System Requirements

g relies on both text and graphical output to assist users in quickly evaluating instrument performance and results. *g* runs best with the following minimal standards:

Operating System:	Windows 98, 2000, NT, XP
Free Hard Drive Space:	15MB or greater
RAM:	64MB or greater
Processor:	Intel™ P2 or greater
Processing Speed:	200MHz

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[1] After data conversion through the "CONVERT" tool.

Installing *g*

Licensed users of *g* will receive one Compact Disc media with at least the following[2]:

1. README.TXT (f) – Overview of installation procedures
2. gHelp.pdf(f) – This document
3. Setup.exe(f) – Install application for Windows 98 Machines
4. gSysChk.exe (f) – System Password generation application.
5. gWaveFiles(d) - Earth Tide and Ocean Loading Tide binary data files.
6. gSampleData(d) – Sample data for practice processing.
7. LICENSE.TXT – Standard Software Licensing Information.

If you do not have ALL the listed files and/or directories on your CD, please contact MGS immediately.

- COMPLETELY UNINSTALL ALL PREVIOUS VERSIONS OF *g*.
- Note that all users will need to generate a new gPWInfo.bin file if they are using g versions previous to 5. See installation details below.
- Double click the Install application. Follow the instructions. It is highly recommended that you accept ALL default installation paths.
- From the Micro-g Solutions Program files menu, run the g5SysChk.exe program and generate the SysChk.bin file
- Email SysChk.bin to Maryann King at mking@microgsolutions.com and wait for her to send you gPWinfo.bin[3]. This usually takes less than twelve hours during normal the business week.
- Upon receipt of gPWInfo.bin, manually copy the file into the newly created BIN directory of Micro-g Solutions. (Usually c:\Program Files\Micro-g Solutions\BIN). If a valid password is not found in the BIN directory, *g* issues the warning "Invalid Password File" and exits after acknowledgement from the user.

You are now ready to run *g*.

IMPORTANT! Due to how the software protection in *g* works, if at any time the user adds or removes hardware from the computer in which *g* is installed, they must obtain a new password file by following the above steps.

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[2] (f) and (d) indicate "file" and "directory" respectively
[3] Security files are unique to each computer. Please send only ONE file at a time.

Post-Mission Processing

To learn how to process absolute gravity data in post-mission (after the data has already been collected and archived), we will use the sample data included on the distribution disk (gSampleData). Acquiring data in real time is discussed below.

g Binary Data Files Structure

The data file structure of the *g* software is very different from the Olivia DOS-based software. *g* maintains a binary project file that contains all the station, system, acquisition, control and comments information used when occupying a absolute gravity station, as well as a list of all names of the set files. Project files have the project name as the prefix and end in a "fg5" extension. For example, the gSampleData directory contains a project called "Erie 09 jan 02a.fg5".

Raw observation data for each set is stored in a binary gravity set file with a "gsf" extension. All raw data including time of drop, fringe times and auxiliary sensor(s) data is stored in this file. The files must be accompanied by the corresponding project file in order to be processed by the *g* software.

Set files are named sequentially based on the PROJECT FILE NAME, the number of the set, and the "GSF" extension. For example, in the gSampleData where the project name is "Erie 09 jan 02a.fg5", the raw data file for the 5th set is named, "Erie 09 02a005.gsf". The raw data file for the 12th set is named "Erie 09 02a012.gsf".

IMPORTANT! When transferring, sharing, or archiving *g* data, it is necessary to include the Project file (fg5) and ALL the set (gsf) files together. (The other files, *.txt, and project graphs, can be recreated by the software, and it is technically not necessary to archive those.)

How g works

g allows users to interactively change and select processing parameters and/or sets and drops through standard Windows™ controls, including trees, dialog boxes, drop-down text boxes, check boxes and radio buttons. If necessary, prior to processing a data set the user will select and/or modify the appropriate processing parameters and which specific sets and/or drops to include in the processing. *g* processes data sequentially; That is, each set is (re)processed in the order it was observed. If a change is made in the processing parameters, it is necessary for all data to be completely reprocessed.

Starting g

To start *g* double click on the *g* icon. The screen shown in Figure (1) will appear on the screen. Select Project | Open and navigate to the gSampleData directory. Select the file "Erie 09 jan 02a.fg5". The program environment will now appear as shown in Figure (2).

The Set data filenames are displayed in the left set view/control window. Notice that for this example, each set is named sequentially (in this example 001 through 012) with the project name used as the prefix and "gsf" as the suffix. By default *g* opens four "Views" of the data at start-up. Each view can be enabled by the tab control at the lower part of the window. The default windows are:
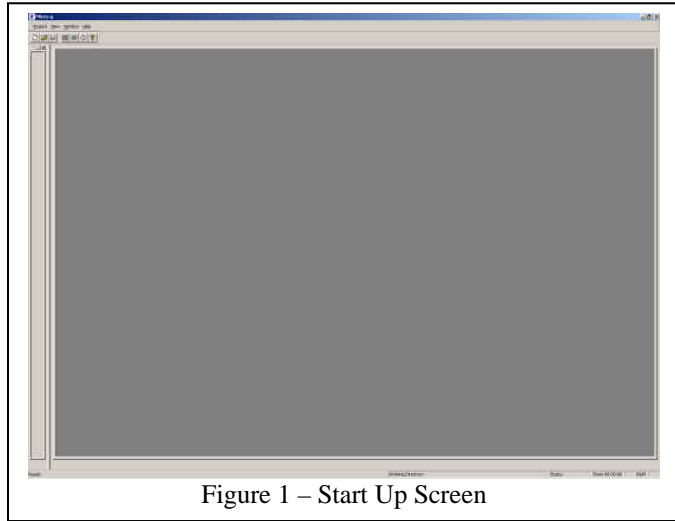
The State Window

Figure 1 – Start Up Screen

The main window *g* uses to convey information to the user is the State Window. The State Window contains four separate sections[4] (note that the meaning of each box value can be determined by "hovering" the mouse cursor over the box until the "tool tip" appears):

- Setup – Basic setup and station information is displayed here including Latitude, Longitude, Elevation, Standard Pressure, Gradient, System Type, System Serial Number, Number of Sets Acquired (or to Acquire for Realtime), Number of Drops per sets, Time interval in minutes between sets and time interval in seconds between drops.

- Drop – Information about each individual drop including time, absolute gravity, standard deviation, RMS, number, accepted (a) or
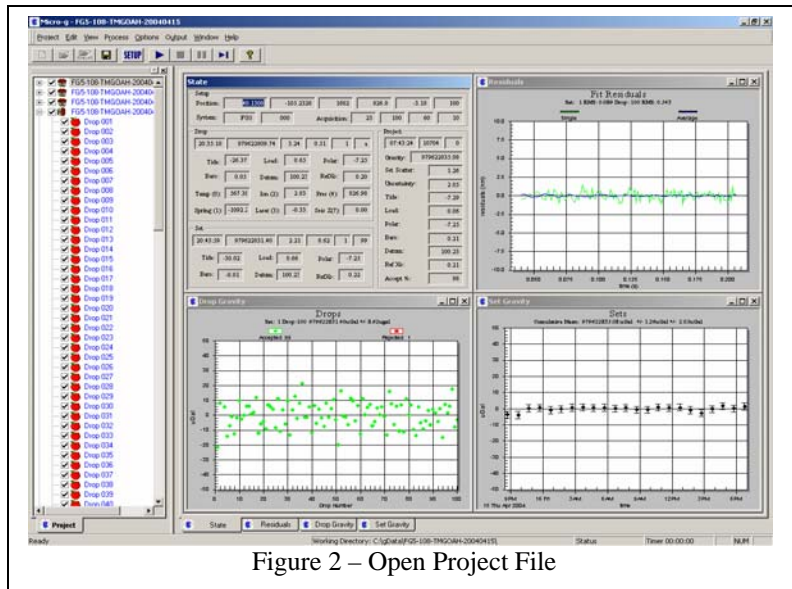
Figure 2 – Open Project File

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[4] Definitions for corrections are contained in Section Processing Control and Corrections.

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rejected (r) and Laser Lock code, tide correction, ocean loading correction, polar motion correction, barometric correction, datum transfer correction, reference Xo correction, temperature (C), super spring position (V), Ion pump monitor (V), laser output (V), barometric pressure (mBar) and average seismometer reading (V).

- Set – A group of drops is referred to as a "set". Information about each individual set including mean time of the accepted drops in the set, mean absolute gravity, total uncertainty, drop to drop scatter, set number, number of accepted drops, percentage of accepted drops, mean tide correction, mean ocean loading correction, mean polar motion correction, mean barometric correction, mean datum transfer correction, and mean reference Xo correction.
- Project – The group of all the sets constitutes a "project". Summary information about the project including mean time of sets processed, set to set scatter, total uncertainty, mean tide correction, mean ocean loading correction, mean polar motion correction, mean barometric correction, mean datum transfer correction and mean reference Xo corrections.

Drops

The Drops view displays individual drops minus the mean value of the set. Accepted drops, i.e. those that are within the user-selected statistical range, are plotted in green, while rejected drops are plotted in red. The top of the view informs the user of the current set number, the current drop number, the current drop-to-drop scatter of the set, as well as the number of drops accepted and the number of drops rejected.

Fit Residuals

The Fit Residuals View displays the residual signal (the difference between the actual fringe time and the least squares fit)[5]. With system response disabled (figure 3b), the green signal is the residual vector from the current drop while the blue signal represents the average residual of the accepted drops. If the instrument is working properly, the blue signal should ALWAYS be smaller in amplitude than
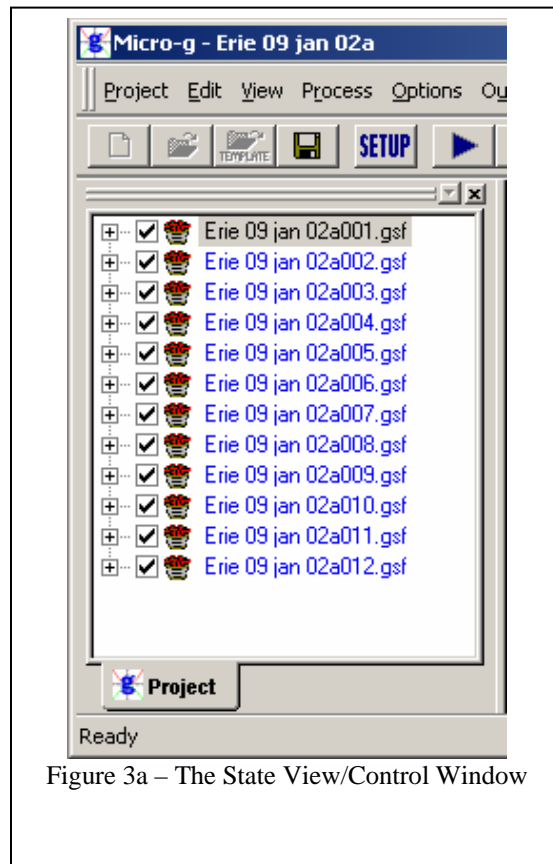
Figure 3a – The State View/Control Window

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[5] The Residual Signal is comprised of the differences between the actual observed time distance pairs and the estimated time distance pairs determined from the least squares estimated parabolic trajectory.

the green signal. If a drop is rejected, it's residual signal is plotted in red.

If system response is enabled (figure 3c – see **System Response** discussion below), the orange signal is the compensated residual vector from the current drop, the green signal is the uncompensated residual vector from the current drop, and the purple signal represents the compensated average residual of the accepted drops.

Figure 3b – System Response Disabled

Figure 3c – System Response Enabled

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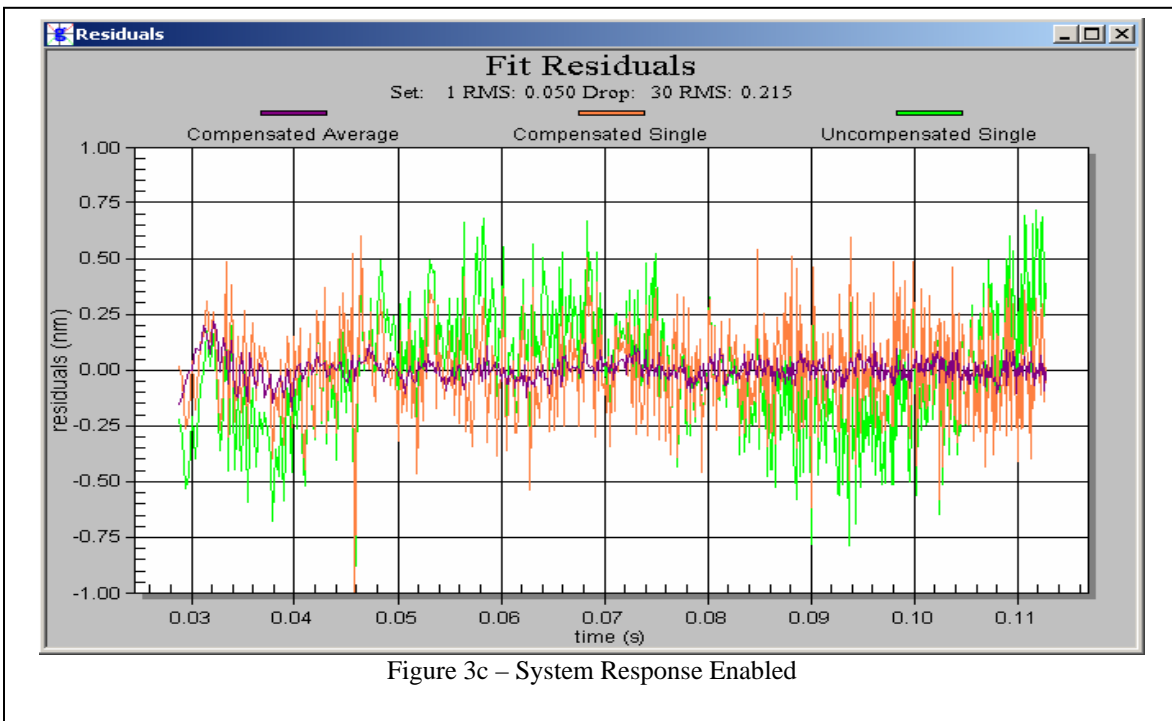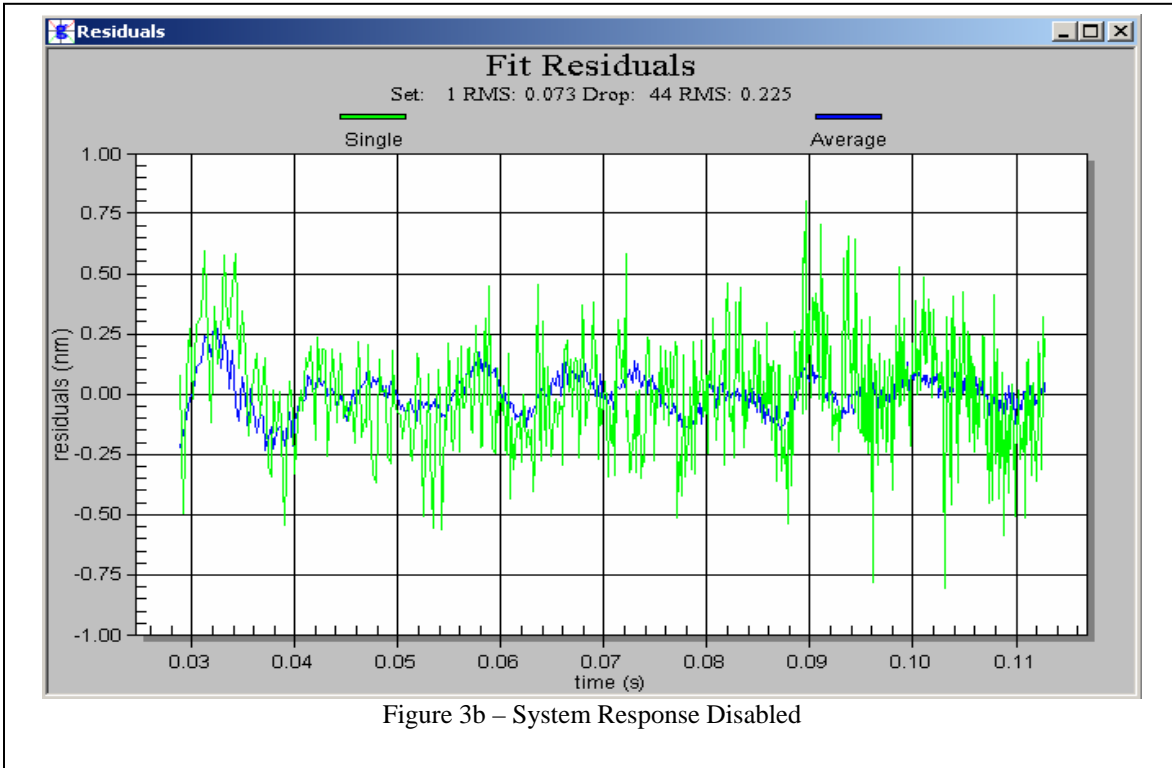
Sets

The Sets view displays individual set gravity values minus the mean value of the project.

Each set is plotted with an error bar that indicates the range of the uncertainty for the individual set. The top of the view informs the user of the current cumulative mean for the project, the set to set scatter, and the total uncertainty of the project mean.

The Set View/Control Window

By default *g* displays the Set View/Control Window at start-up. This window is used to select which sets are to be processed and to set a break point in the processing if necessary. The figure below shows a detailed view of the Set View/Control Window.

The check boxes to the left of the Set Filename indicate whether or not the set is included in the processing. Sets may be checked or unchecked by placing the mouse cursor directly over the box and clicking the left mouse button.

Optionally, if the left mouse button is single clicked over the filename, the set is highlighted. To highlight multiple sets, highlight one set then use the <SHIFT> key and <↑> or <↓> arrow keys accordingly. The right mouse button will bring up the floating menu shown in Figure 4. The following options are available:

Figure 4 – Right mouse button State View/Control Menu

- Check Selected – Checks all highlighted sets.
- UnCheck Selected – Unchecks all highlighted sets.
- Check All – Checks all sets.
- Check Red – Checks all odd numbered sets (for use in ML-1 Red/Blue Lock Analysis)
- Check Blue – Checks all even numbered sets (for use in ML-1 Red/Blue Lock Analysis)
- Set Break Point – Places a "Break Point" marker by the selected set. *g* will process up to the break point and pause.
- Clear Break Point – Clears the breakpoint.

When reprocessing data for the first time after collecting data and reopening a project, it is best to process ALL sets in the project, then go back and delete unwanted sets. The Process | Quick Update option from the main menu can be used to quickly recalculate the mean project gravity value and update the set views if no parameters are changed. If any

processing parameters are changed, *g* automatically recalculates gravity for the entire data set.

Processing Data

Reviewing Processing Parameters

Processing parameters may be reviewed through the Process | Setup screen shown in Figure 5 (the user may also press the F3 key to vie the Setup screen). All processing parameters are stored in the .FG5 file. The Process | Setup menu performs as a data acquisition and data processing electronic notebook. There are five tab dialog windows contained in the Setup menu:

- Information – This menu controls WHERE the instrument is located. The user can enter Site Name, Site Code, Latitude (DD), Longitude (DD), Elevation (m, MSL[6]), Nominal Pressure (mBar), Gradient (µGal/cm), Datum Height (cm), Measured Reference Height (cm), Barometric Factor (µGal/mBar), Polar motion X component (arcsec), Polar motion Y component (arcsec).
- System – This menu allows the user to enter Instrument Type, Model Serial Number, Interferometer Type, Laser Type (and wavelengths if applicable), Seismometer data collection enabled (if applicable, FGL Series instruments only), Fringe Card type and setup, Analog to Digital data acquisition card and setup, Serial Barometer setup. The ADVANCED button and details of System setup are discussed in **Real-time Data Processing**.
- Acquisition – This menu control HOW the INSTRUMENT collects data. The user can set the number of sets to collect, number of drop per set, start time (immediate or delayed), drop interval, set interval and pulse delay (the time between the drop and the next lift). These options are cannot be edited in post-mission mode and are discussed in **Real-time Data Processing**.
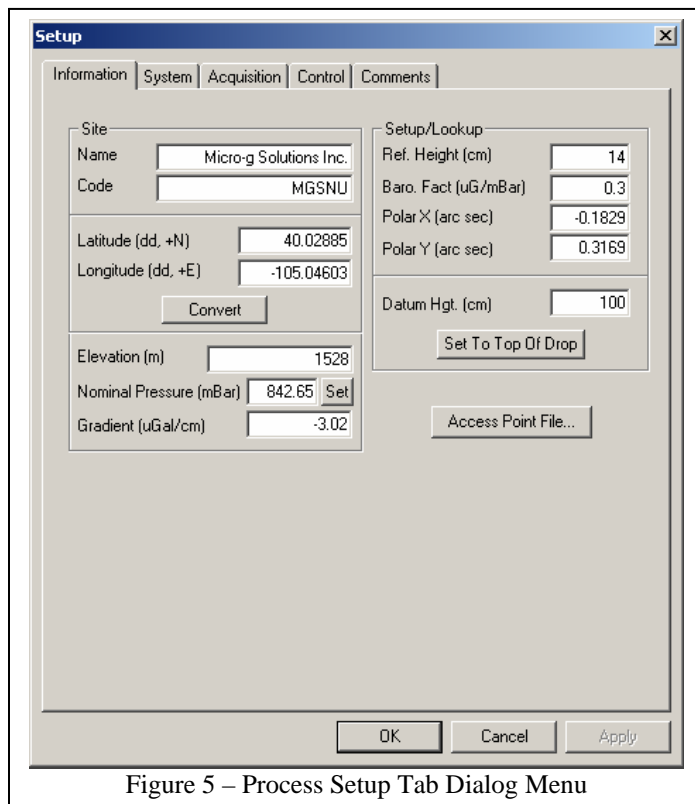
Figure 5 – Process Setup Tab Dialog Menu

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[6] (MSL) Mean Sea Level

- Control – This information controls HOW the SOFTWARE treats the data. The user can enable barometric pressure corrections, polar motion corrections, reference Xo correction and datum height to be applied to the data. The user may select tidal terms to be either Berger or ETGTAB, whether or not to apply system response, laser mode (Automatic Peak detection in the case of a WEO-100 laser or Red/Blue alternate in the case of an AL-1 or ML-1), fit for wavelength modulation (WEO -100only), starting fringe from which to begin processing, number of fringes to process and statistical parameters. These items are covered in more detail in **Processing Gravity Data**.
- Comments – Users may enter up to 100 lines of field or processing notes in this section.

For now, we will NOT change any processing parameters on the sample project.

Start Processing

Once *g* is setup according to user-set parameters, it is ready to begin processing the data. Processing can be started three ways:

1. The user may select Go… from the Process menu.
2. The user may push the blue "Go" button.
3. The user may press "F5".

After starting either option (1) or (2) above, in post-mission processing, *g* will prompt the user whether or not to overwrite the current existing Project and Set summary files. *g* creates two output ASCII text files by default, the Project Summary and Set Summary File. By default, the files are named *<project name>.project.txt* and *<project name>.set.txt*. In some cases, users will want to change the names of the output files to preserve prior processing results. For details of the ASCII output file structure and contents, see Appendix (2) – ASCII Output Files.

Let's select "No" and enter our own default base name, "goutput1". By default then, *g* will create two ASCII text files, *goutput1.project.txt* and *goutput1.set.txt*. After pressing the "OK" button, *g* will begin processing the data.

Selecting "Yes" would simply overwrite the *<project name>.project.txt* and *<project name>.set.txt* files.

Processing Status

With the default windows displayed, State, Drops, Sets and Fit Residuals, the user is able to quickly evaluate the status of data processing. In Figure 6a and Figure 6b below, we have set a break point at Set 3 to pause the processing. The screen is captured immediately following the last processed drop of Set 2.

The Sets window in the upper left hand corner of shows the two previously processed sets and their Uncertainty error bars. The two sets are plotted with the mean subtracted. The mean value is written above the graph.

The Fit Residuals window in the upper right hand corner of Figure 6a shows the average residual signal for Set 2 in blue and the single drop residual signal for Drop 100, Set 2 in green.

If the system response is enabled (discussed below), the Fit Residuals window in the upper right hand corner of Figure 6b shows the compensated average residual signal for Set 2 in purple, the compensated single drop residual signal for Drop 100, Set 2 in orange, and the uncompensated single drop residual signal for Drop 100, Set 2 in green.

The Drops window in the lower right hand corner shows all the gravity values for Set 2 with the mean subtracted, while the State window in the lower left hand corner shows text information for Drop 100-Set 2, Set 2, and the cumulative average for the entire project.

Figure 7 is a closer look at the State Window shown above.

As previously mentioned, the State Window is ALWAYS displayed and contains the most information of any of the twelve views. In Figure 6, basic project setup information is shown in the top window including the position (40.02885, -105.04603, 1528), nominal pressure (842.65), gradient (-3.02), the instrument type and serial number, (FG5 206) and the acquisition parameters (12 sets, 100 drop/set, 60 minute set intervals, 10 second drop intervals). In order to display information to the user and keep the view uncluttered, many of the boxes are NOT labeled. However, by "hovering" the mouse cursor over each box, a "tool tip" will appear with a description of the value.

The second box (Drop) contains information pertaining to the current drop being processed. In the case of Figure 6, the drop is 100. The time of the drop is displayed (01:24:56), the corrected absolute gravity value of the last drop (979647287.69), the standard deviation of the drop[7] (26.39), the RMS of the drop fit (nm) (0.93), the drop number (100), whether or not the drop was accepted or rejected and the peak lock ("aE" implies accepted, E lock). The next six boxes show the corrections in µGal for tide (25.00), ocean loading (0.0), polar motion (-6.66), barometric (1.80), datum transfer (91.51), and reference Xo (0.01). The final six boxes show the current value of the sensor channels for ONLY the first six channels. All values are listed in mV[8] and correspond to the standard patch panel configuration on all Micro-g instruments.

The third box (Set) contains information pertaining to the current set being processed. In the case of Figure 6, it is Set 2. The average time of the accepted drops used to calculate the set mean is displayed (01:16:33), the average corrected gravity value (979647288.94), the uncertainty of the set in µGal (2.33), the drop to drop scatter in µGal (9.19), the set

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[7] As determined from the least squares solution.
[8] Values are in mV unless otherwise scaled and/or offset in the Analog to Digital Setup

number (2) and the number of drops accepted (97). The next six boxes display the average value of the corrections applied in μGal: tide (18), ocean loading (0.00), polar motion (-6.66), barometric (1.71), datum transfer (91.51) and reference Xo (0.01).

The final box (Project) contains information pertaining to the current state of the project through the last processed set (In this case, Set 2). The average time of the sets is shown
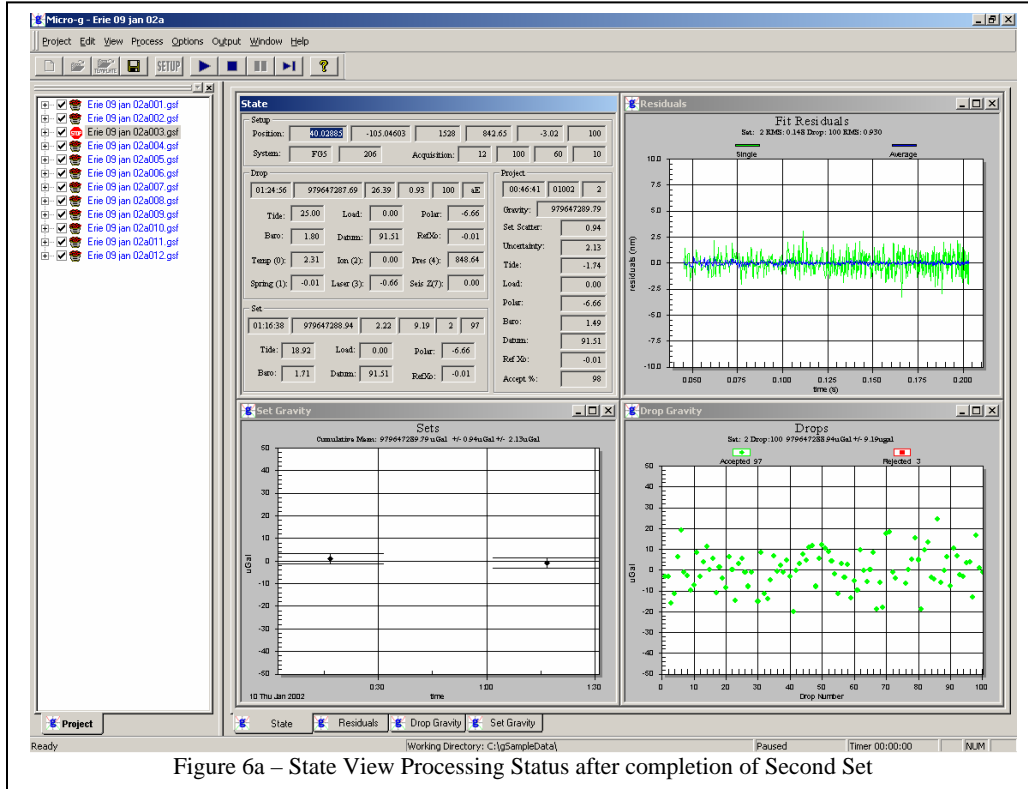
Figure 6a – State View Processing Status after completion of Second Set
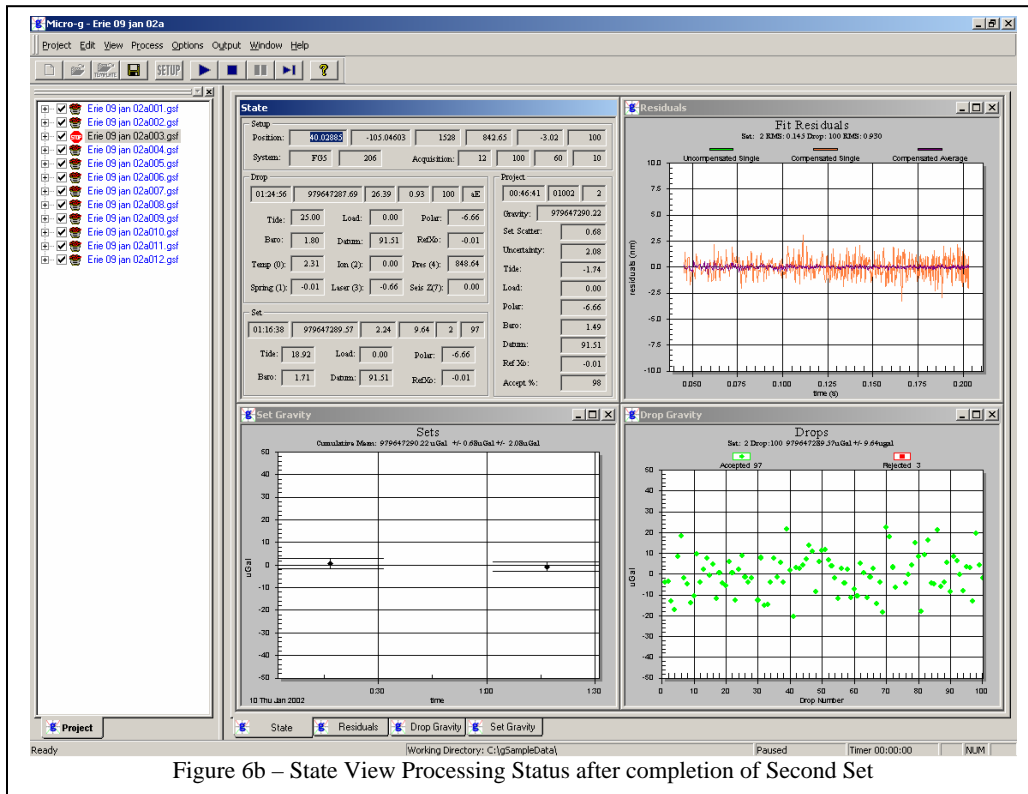
Figure 6b – State View Processing Status after completion of Second Set
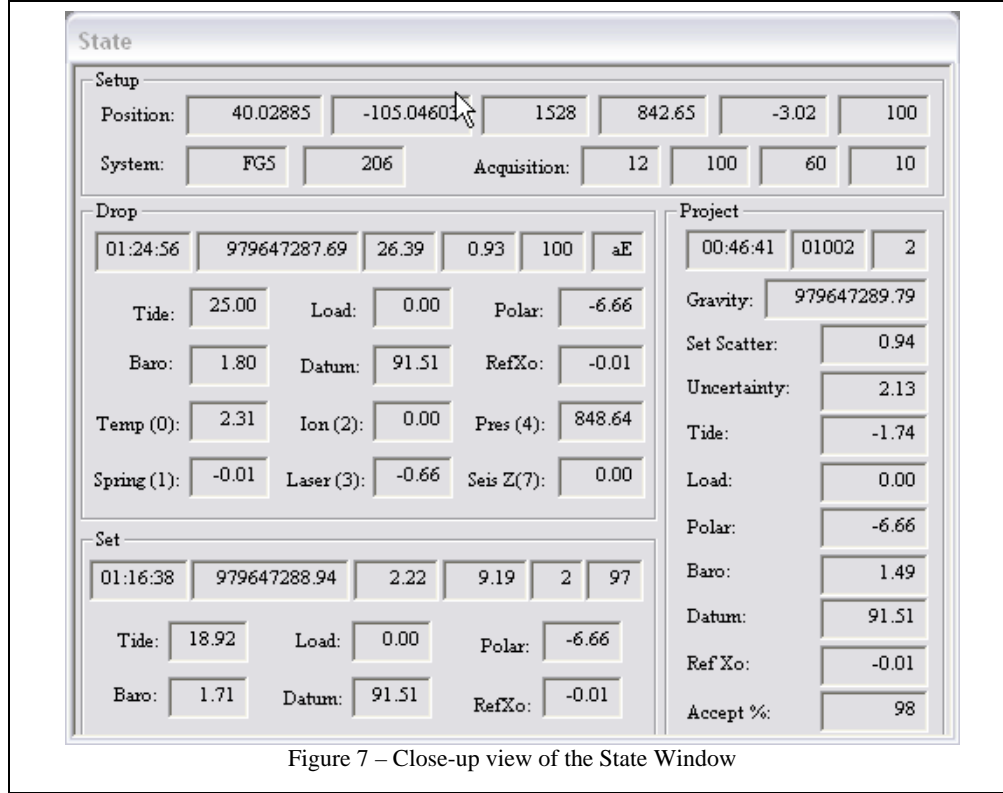
Figure 7 – Close-up view of the State Window

(00:46:41), the day of the year and last two digits of the current year (01002 implies the tenth day of the year 2002), the number of sets processed (2), the average corrected gravity (979647289.79), the set to set scatter in µGal (0.94), the set uncertainty in µGal (2.13), and the average applied corrections in µGal.

To restart the processing, press "F5" or select "Go" from the Process menu.

Processing Finished

Processing is complete when the two "beeps" sound from the computer's speaker (NOTE: the beeps do not sound from an installed sound card but ONLY the computer's local speaker) and when the bottom message window indicates "Finished"

For our example, the final gravity value is 979647292.67µGal with a set scatter of ±2.26µGal and a total uncertainty of ±2.24µGal.

Reviewing Processing Results

Remember when we changed the output name to "goutput1"? If we use Windows Explorer to navigate to the gSampleData directory, we will see two new files, goutput1.project.txt and goutput1.set.txt. These files are ASCII text and can be opened with any text editor.

Project Summary File

The project summary file is designed to be a "snapshot" of the acquisition and data processing. It is intended to serve as the primary resource for archiving absolute gravity data.

The project summary file is reproduced below in Figure 8. Explanations of each line are included in the figure, but are NOT normally part of the output file. The output data is divided into related sections, File creation and Header Information, Station Information, Instrument Data, Processing Results, Gravity Corrections, Uncertainties and Comments. Depending on the options selected (Laser, Tide Model, Ocean Loading), sections may include additional information.

Set Summary File

The set summary file contained in goutput1.set.txt contains set by set information including Set Number, Time, Day of Year, Year, Gravity, Set Standard Deviation, Set measurement precision, Set uncertainty, tide correction, barometric correction, polar motion correction, datum transfer correction, reference Xo correction, temperature, pressure, auxiliary channels and number of drops accepted and number of drops rejected. The file is tab delineated and is easily imported into most spreadsheet programs.

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goutput1.project with annotations - Notepad                                    _ □ ×
File  Edit  Format  Help

g Acquisition Version:  1.1217              | Which Version of "g" acquired the data
g Processing Version:  2.0128               | Which version of "g" processed the data

Company/Institution: DPR                    | Institution Name (for reference)
Operator: Juan Diego Montoya                | Operator's Name (for reference)

Station Data                                | Station Data Section
Name: Micro-g Solutions Inc.                | Station Name
Site Code: MGSNU                            | Site Code of the Station
Lat:  40.02885 Long: -105.04603 Elev: 1528.00m | Position of the station
Reference Height: 14.00cm                   | Measured Reference Height
Datum Height: 100.00cm                      | Selected Datum Height
Gradient:  -3.02uGal/cm                     | Site Gradient
Nominal Air Pressure:  842.65mBar           | Nominal Air Pressure at the Site
Barometric Admittance Factor:  0.30         | Barometric Admittance Factor
Polar Motion Coord: -0.183"  0.317"         | Polar Motion Coordinates

Instrument Data                             | Instrument Data Section
Meter Type: FG5                             | Instrument Type
Meter S/N: 206                              | Instrument Serial Number
Factory Height: 116.30cm                    | Micro-g Determined Factory Height
Rubidium Frequency:  10000000.00000Hz       | Frequency of the time standard
Laser: WEO (6788ik34)                       | Laser type and serial number
ID: 632.99117754nm ( -0.36V)                | D Peak and measured voltage
IE: 632.99119473nm ( -0.73V)                | E Peak and measured voltage
IF: 632.99121259nm ( -1.03V)                | F Peak and measured voltage
IG: 632.99123023nm ( -1.30V)                | G Peak and measured voltage
IH: 632.99136890nm ( -1.43V)                | H Peak and measured voltage
II: 632.99139822nm ( -1.20V)                | I Peak and measured voltage
IJ: 632.99142704nm ( -0.90V)                | J Peak and measured voltage
Modulation Frequency:  8333.420Hz           | Modulation frequency of the laser

Processing Results                          | Processing Results Section
Date: 01/10/02                              | Date of gravity Value
Time: 05:46:36                              | Time of gravity Value
DOY: 010                                    | Day of year of gravity value
Year: 2002                                  | Year of gravity value
Gravity:  979647292.67uGal                  | Absolute value of gravity (uGal)
Set Scatter:  2.26uGal                      | Set to set scatter (uGal)
Measurement Precision:  0.65uGal            | Measurement precision (uGal)
Total Uncertainty:  2.24uGal                | Uncertainty of the final value (uGal)
Number of Sets Collected:     12            | Number of sets Collected
Number of Sets Processed:     12            | Number of sets included in the processing
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12 | Sets included in the processing
Number of Sets NOT Processed:     0         | Number of sets NOT processed
Set #s NOT Processed:                       | Sets not included in the processing
Number of Drops/Set:  100                   | Number of drops in each set
Total Drops Accepted:     1193              | Total number of drops accepted in processing
Total Drops Rejected:        7              | Total nubmer of drops rejected in processing
Total Fringes Acquired:     700             | Fringes acquired during each drop
Fringe Start:    30                         | Starting fringe from which to process
Processed Fringes:     600                  | Number of fringes to include in processing
GuideCard Multiplex:     4                  | Guide Card Multiplex setting
GuideCard Scale Factor:    250              | Guide Card Scale Factor setting

Gravity Corrections                         | Gravity Corrections Section
Earth Tide (Berger): 51.97uGal             | Average Earth Tide Correction and Model Selected
Tidal DC Term:  1.00                        | Tidal DC term used for earth tide correction
Polar Motion: -6.66uGal                     | Average Polar Motion Correction
Barometric Pressure:  2.64uGal              | Average Barometric Pressure Correction
Datum Height: 91.51uGal                     | Average Datum Height Correction
Reference Xo:  0.01uGal                     | Average Reference Xo Correction

Uncertainties                               | Uncertainty Summary Section
Earth Tide:  0.50uGal                       | Uncertainty Component due to Earth Tide +/-uGal
Ocean Load:  0.20uGal                       | Uncertainty Component due to Ocean Load +/-uGal
Barometric:  1.00uGal                       | Uncertainty Component due to Barometric +/-uGal
Polar Motion:  0.05uGal                     | Uncertainty Component due to Polar Motion +/-uGal
Laser:  0.05uGal                            | Uncertainty Component due to Laser +/-uGal
Clock:  0.50uGal                            | Uncertainty Component due to Clock +/-uGal
System Type:  1.10uGal                      | Uncertainty Component due to System Type +/-uGal
Tidal Swell:  0.00uGal                      | Uncertainty Component due to Tidal Swell +/-uGal
Water Table:  0.00uGal                      | Uncertainty Component due to Water Table +/-uGal
Unmodeled:  0.00uGal                        | Uncertainty Component due to Unmodeled +/-uGal
System Setup:  1.00uGal                     | Uncertainty Component due to System Setup +/-uGal
Gradient:  0.91uGal ( 0.03uGal/cm)          | Uncertainty Component due to Gradient +/-uGal


Comments                                    |
First Demo Run                              |
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Figure 8 – Output Summary for Project Text File

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Output Displays

In addition to the default displays, Tree Control, State, Drops, Sets and Fit Residuals, *g* also supplies a variety of views to convey information about processing (or data acquisition) status. A description of each view not previously described follows:

- *Set Histogram* – Displays a histogram of the processed sets. In general, users should expect to see normally distributed data.
- *Set Sensors* – Displays up to six separate charts. Charts 1-5 show the default channels for a Micro-g Patch Panel: Temperature, Super Spring, Ion Pump, Laser and Barometer. The sixth chart is reserved for channels 6, 7 and 8 and stacks all three channels onto one graph if enabled.
- *Set Corrections* – Displays six separate charts, one for each type of correction applied to the calculated gravity value: Tide, Ocean Loading, Polar Motion, Barometric, Datum Transfer and Reference Xo. Units are in µGals.
- *Set Fit Sensitivity* – Displays the set standard deviations.
- *Drop Histogram* - Displays a histogram of the processed drops for the currently processed set. In general, users should expect to see normally distributed data.
- *Drop Sensors* - Displays up to six separate charts for the currently processed set. Charts 1-5 show the default channels for a Micro-g Patch Panel: Temperature, Super Spring, Ion Pump, Laser and Barometer. The sixth chart is reserved for channels 6, 7 and 8 and stacks all three channels onto one graph if enabled.
- *Drop Corrections* - Displays six separate charts, one for each type of correction applied to the calculated gravity value for the current set: Tide, Ocean Loading, Polar Motion, Barometric, Datum Transfer and Reference Xo. Units are in µGals.
- *Drop Parabola* – Displays the trajectory of the object with time on the X axis and distance on the Y axis. This graph is useful to view dropping chamber and fringe data acquisition performance.
- *Drop Seismometer* – This view is applicable for "LS" meters only and has two components. If seismometer data is used directly in the solution, the graph shows the compensated versus uncompensated residuals (nm). If the seismometer data is NOT used in the solution, the graph shows the seismometer velocity (mV).
- *Drop Residual PSD* – This view shows an autoscaled PSD of the residual signal ONLY IF Frequency Response is enabled.
- *Drop Fit Sensitivity (Top and Bottom)* – Displays the change in the calculated gravity value as different portions of the drop fit are selected. Values are displayed relative to the value determined at the nominal fit (selected in Setup|Control). See **Fringe Data** and **Fit Sensitivity** below.

IMPORTANT!: Viewing many displays can significantly slow down data processing and this can in turn result in potential memory violations. If your system does NOT have a high end gaming graphics card or low end CAD graphics card (>32mb on-board memory), minimize the number of open views.

FAST TIP! To "Tile" or "Cascade" views, press "T" or "C".

Processing Control and Gravity Corrections

g allows the user to apply all the recognized corrections to the trajectory acceleration to determine an accurate value for absolute gravity. These corrections are turned on or off at the Process | Setup | Control page. The Control page is shown below:

Barometric Pressure

The observed gravity is normalized to a nominal pressure at each site by applying a correction based on the observed atmospheric pressure during the observations. This pressure correction is applied at each drop. The formula used to compute the pressure correction is:

$$C(p) = A* (P(o) - P(n))$$

where:

A = The barometric admittance factor (μGal/mBar) specified in the Information Setup. This value is usually between 0.30 and 0.42. The recommended value (per IAG, 1983) is 0.30.
C(p) = Barometric Pressure Correction in μGal.
P(o) = Observed barometric pressure.
P(n) = Nominal barometric pressure in accordance with DIN Standard #5450.

Polar Motion

This correction compensates for changes in centrifugal acceleration due to variation of the distance of the earth's rotation axis from the gravity station. This correction is normally re-computed using pole positions that are determined nearest to the observation time for each station. The formula specified in the IAGBN: Absolute Observations Data Processing Standards (1992) is used. The formula reads:

$$\delta g = -1.164 x 10^8 \omega^2 a 2 \sin\varphi \cos\varphi (x\cos\lambda - y\sin\lambda)$$

where:

δg = polar motion correction in μGals,
ω = earth's angular rotational velocity (rad/s),
a = semi-major axis of the reference ellipsoid (m),
φ = geodetic latitude (rad),
λ = geodetic longitude (rad),
x,y = polar coordinates in the IERS system (rad).

Mean pole positions are determined at daily intervals and issued daily by the IERS Bulletin. The Bulletin A containing the polar motion coordinates in final and predicted format is available at no cost on the web at http://maia.usno.navy.mil/bulletin-a.html .

Reference Xo

In the equation of motion[9] as used in *g*, gravity is determined at t_o not at x_o. In order to move gravity the fractional amount to the zero reference position, the x_o position is multiplied by the site gravity gradient. This correction is generally very small (<0.05μGal).

Datum Height

The observed gravity for each drop can be transferred to a user specified height entered on the site information page. The transfer is calculated by adjusting the gravity value using the difference between the measured reference height plus factory height and the datum height, and multiplying the difference by the site gravity gradient.

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[9] For more information see Niebauer et. al, A New Generation of Absolute Gravimeter, Metrologia, 1995.

Tidal Correction

The effect of lunar-solar mass attraction is computed and applied to the observations (each drop). A gravimetric factor (usually 1.16) is used to compute the effect of tidal uplift in the continental crust due to the mass attraction of the sun and moon. *g* allows for two types of Tidal Corrections

- Berger – Originally written by Jon Berger in 1969 and modified by several others throughout the years.
- ETGTAB – Originally compiled by the late Georg Wenzel, ETGTAB uses a more sophisticated calculation.

Earth tide models are discussed in more detail below.

System Response

System response is an advanced fitting routine that fits multiple numbers of damped sinusoids to the standard equation of motion. To apply System Response[10], check the box and press the Setup button. The menu shown in Figure 9 to the right will appear. It is recommended to accept the default values of 3, 70% and 15Hz for maximum number of terms, significance threshold and minimum frequency respectively. When System Response is enabled, it is possible to view the Power Spectral Density of the Residual Signal.
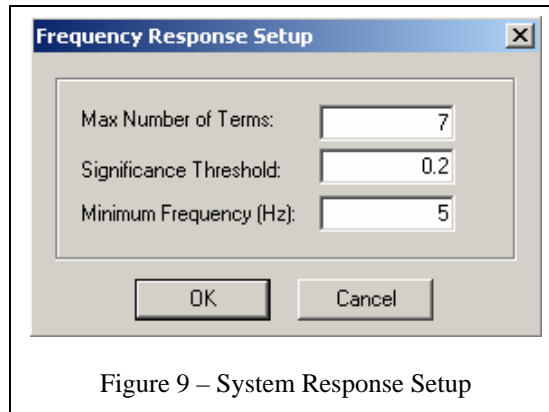
Figure 9 – System Response Setup

Laser Control

The software is designed to function with three different laser types. For WEO-100 lasers, the user can select Automatic Peak Detection. *g* uses the measured voltage on Channel 4 to determine which peak (DEFG or GHI) was valid during the drop. If for some reason the voltage in channel 4 is invalid, the user can still deselect Automatic Peak Detection and manually enter the wavelength from the pull-down menu. The wavelength modulation check box is only valid for WEO-100 lasers, and it is recommended that the box ALWAYS be selected (and that the correct modulation frequency is entered in the system laser setup box). Refer to the WEO manual for discussion of the modulation frequency.

WEO-200 lasers are also supported, but there is no peak detection nor modulation frequency.

For ML-1 or AL-1 lasers, the user can select the red or blue wavelength, or select Alternate. In Alternate mode, the software will send an impulse signal through the digital output of the patch panel and switch between the two modes between each set. Blue lock sets will be displayed in blue on the Sets view while Red lock sets will be displayed in Red.

Seismometer

If data are taken from an FGL meter enabled with the seismometer option (FGL), this box can be checked to apply the seismometer signal. The compensated signal is determined by integrating the seismometer velocity and subtracting the result from the trajectory. This option is only valid with the FGL option.

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[10] System Response is generally NOT needed for most applications.

Fringe Data

In this section the user can select the starting fringe from which to process data and the number of fringes to include in the trajectory. As of gv5, the user now enters nominal times for the fit (typically ~30ms after the start of the drop and ~5ms before the "catch" portion of the drop), and the program will determine the nearest integer fringe values for both the start and end of the fit.

Fit Sensitivity

Once the nominal start and stop fit times have been selected, the program can also calculate a gravity value for each fringe in a range about both the nominal start and nominal stop of the drop. This allows the user to determine how sensitive the final gravity value is to the choice of fit duration. The user can select a "window" about the nominal start and stop times (typically ±10 ms) and view the sensitivity in View|Fit Sensitivity (Start/Stop). Typical sensitivities should be <2 μGal for an FG5 and less than about 7 μGals for an A10 at a quiet site.

Statistics

This section has been greatly expanded for *g* versions 2.0 and later. As in previous versions of *g*, the drop rejection significance level can be changed. It is recommended that the number be left at 3.0.

The SETUP button now leads to the menu shown in Figure 10. *g* software can now calculate the total uncertainty[11] for each set and for the final project number. This number is based on the estimated uncertainties for many different components of the measurement. Components are grouped into four separate areas: Modeling, System, Environmental and Set-up. Default values are determined from previous publications and from in-house experience.

Modeling

Modeling uncertainties usually do not vary from station to station or among different instrument serial numbers or models. Recommended values[12] for modeling uncertainties are:

Barometric	1.0μGal
Polar Motion	0.05μGal

The errors for the earth tide and ocean load calculations are estimated as fractions of the size of the actual correction (determined at the time of the measurement), and are nominally:

Earth Tide	0.001 x Correction
Ocean Load	0.1 x Correction

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[11] Total uncertainty is determined by taking the square root of the sum of all the individual uncertainties squared plus the measurement precision squared.
[12] The default values are guidelines only. For details, including position and seasonal variation, see Niebauer et. al., A new generation of absolute gravimeters, Metrologia, 1995.

For example, if at a given time the earth tide correction is 50 µGal, then the uncertainty on the correction is 0.05 µGal.
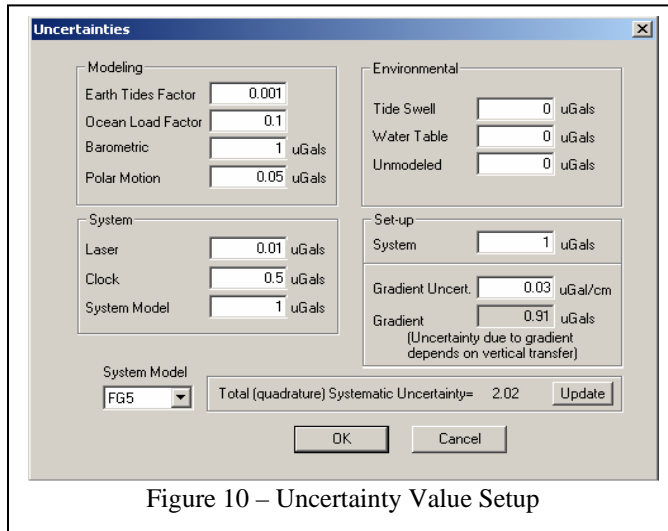

Figure 10 – Uncertainty Value Setup

System

System uncertainties vary depending on what elements are contained in the absolute gravimeter system. FG5 are the most accurate and precise MGS instruments and observations taken from these types of instruments should be weighted much more than those taken from an FgL. Recommended values for modeling uncertainties are:

Laser   0.05µGal (WEO), 0.1µGal (AL-1 or ML-1)
Clock   0.5µGal (Rubidium Oscillator)
System Model   1.1µGal (FG5), 10µGal(A10), 5µGal(A5), 10µGal(I10), 50µGal(FGL)

Environmental

Environmental errors are highly site dependent and should be modified by only experienced users. Recommended values for all environmental uncertainties are 0.0µGal (zero) unless a user is very knowledgeable about the site in question.

Set-up

Set-up uncertainties are depending on both the instrument AND the operator. For example, and experienced operator can set up an FG5 with a system error of 1.0µGal. An experienced relative meter operator can measure a gradient to 0.03µGal/cm. Set-up errors change according to the instrument and may be increased with respect to the operator. Recommended values for modeling uncertainties are:

    System   1.0µGal (FG5), 3µGal (All others)
    Gradient   0.03µGal/cm (For experienced relative meter operators)

Default Settings

On the lower left hand corner of the Uncertainty Setup page is a drop-down dialog box and an Apply button. To set the MGS recommend guideline values for a specified instrument, choose the appropriate instrument in the dialog list and press the APPLY button.

Real-time Data Processing

g allows both real-time data acquisition and post mission processing. To begin a data acquisition project, choose Project | New from the main *g* menu. The four default screens will appear, but there will be NO information in the Set Tree view. By default, *g* is set to run from Micro-g Solutions using an FG5 instrument. To set the software up for data acquisition and processing, users usually must modify some or all of the parameters under Process | Setup.

Information

This menu controls WHERE the instrument is located. The user can enter Site Name, Site Code, Latitude (DD), Longitude (DD), Elevation (m, MSL), Nominal Pressure (mBar), Gradient (µGal/cm), Datum Height (cm), Measured Reference Height (cm), Barometric Factor (μGal/mBar), Polar motion X component (arcsec), Polar motion Y component (arcsec). The user may choose to enter this information from a pre-created file.

Convert Button – The user can click this button if he would like to convert Degree/Minutes/Second (DMS) coordinates to Universal Transverse Mercator (UTM) coordinates to decimal degrees (DD).

System

System – The following parameters may be set from the System Page:

Instrument

- Instrument Type - Users may select FG5, A10 or FgL. Certain options are enabled or disabled according to the instrument selection.
- S/N – User may enter the serial number for note keeping purposes.
- IF Type – Users may select the interferometer type for note keeping purposes.
- Laser Type – Users may select the laser type and parameters associated with the laser.
  - WEO – Laser Voltage and Serial Number
  - ML-1/AL-1 – Blue and Red Lock wavelength[13], Warm-up Mode (if the options is installed on the laser) and serial number for note keeping purposes.

GPS (Not Yet Available)

Seismometer (FGL Only)

- Seismometer Type – Users may select from a variety of seismometer options supported by Micro-g.

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[13] Note that "Red" and "Blue" are terms of convenience only and may need to be switched if entered incorrectly in the ML-1 Laser Setup box. There is a "SWITCH" button for convenience.

- Sampling Frequency – Users may enter the sampling frequency (Recommend is 10xCutoff)
- Sampling Time – Users may enter the amount of time to sample (Recommended is 200ms for small dropping chambers)

Computer Interface Cards

- Fringe Card – Currently Micro-g support ONLY the GuideTech ISA GT650 series time interval analyzer in realtime acquisition. The SETUP button allows the user to change the default location of the GuideTech configuration file, the base address of the card, the Input Multiplexor and Scale Factor an number of fringes to acquire. Recommended parameters for an FG5 with a large dropping chamber are:
  - FPG File = c:\Program Files\Guide\GT650\FPGA\gt65x2.fpg
  - Address = 310
  - Input Multiplexor = 4
  - Pre Scale = 250 (100 for Small Dropping Chambers)
  - No. Fringes Acquired = 70
- Currently Micro-g Solutions supports the IOTech 200 (ISA) or 2000 (PCI) series A2D boards. In addition, Micro-g Solutions now supports the National Instruments PCI-6013 A2D board. If the system is connected to a Serial Barometer, the connection can be tested by using the TEST BAROMETER button. Be sure to select the appropriate COM port.   The SETUP button allows the user to set the acquisition parameters for each channel. For the standard Micro-g patch panel configuration, these parameters should be for Channel(s) respectively:
  - Temperature (0) – UniPolar, 1.25V, 0, 100
  - Super Spring (1) – BiPolar, 1.25V, 0, 1
  - Ion Pump (2) – BiPolar, 5V, 0, 1
  - Laser Voltage (3) – BiPolar, 5V, 0, 1
  - Barometer (4) – UniPolar, 1.25V, 0, 1
    - Serial Barometer 0, 68.947 [14]
    - Analog 537.5, 125
  - User Sensor(5) – BiPolar, 5V, 0, 1
  - User Sensor(6) – BiPolar, 5V, 0, 1
  - User Sensor or Seismometer (7) – BiPolar, 0.3125V, 0, 1
- Advanced – The ADVANCED button should only be used by knowledgeable users. Options settable under the ADVANCED menu include:
  - Factory Height (Instrument Specific and Set ONLY by Micro-g Solutions)
  - Clock Frequency (Usually Determined by a Standards Laboratory)
  - System Offset (FgL and A10 ONLY as determined by Micro-g Solutions)
  - Hardware TTL Prescale Factor (Determined by Micro-g Solutions)

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[14] Serial Barometer uses the offset and multiplier inside the A2D card set for scaling.

Acquisition

The Acquisition set up page is shown below.
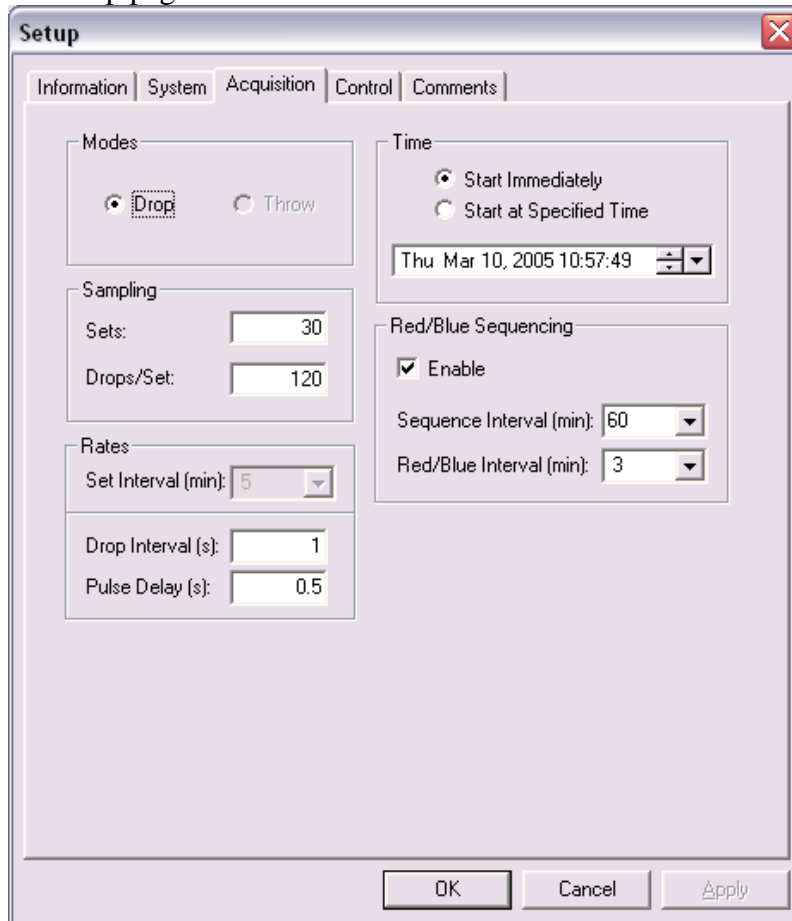
Modes

Currently only the "drop" mode is enabled.

Sampling

- Sets – The user may select the number of Sets to acquire during the project.
- Drop/Set – The user may selected the number of drops in each set during acquisition.

Time

- Start Immediately –Instructs the software to begin data acquisition immediately following Process | Go or "F5".
- Start at Specified Time – Instructs the software to begin data acquisition at the time indicated.

IMPORTANT!! Time on the PC Clock must be set to Coordinated Universal Time (GMT), not local time, with daylight savings disabled.

Rates

- Drop Interval – Used to select the drop rate interval in seconds. Recommended rates are system-dependent. Please consult the system manual.
- Set Interval – Used to select the interval in minutes at which to start new sets. The drop down menu contains some commonly used intervals.
- Pulse Delay – This is the amount of time in seconds between the drop and the time the object is lifted. Systems with digital controllers need much less time to lift than do systems with analog controllers. An approximate value is set automatically by *g*.

Red/Blue Sequencing

Red/Blue sequencing allows users with L Series lasers to acquire data with both laser frequencies in a short time interval and still spread the entire project over a longer time interval. For example, data can be acquired with the red mode and then a few minutes later with the blue mode. Then, after an hour, the whole red/blue sequence can begin again.

- Enable – Enables red/blue sequencing.
- Red/Blue Interval – Time interval between the start of a red set and the start of the next blue set (typically a few minutes).
- Sequence Interval – Time interval between the start of two red sets.

An example of Red/Blue Sequencing is shown below:
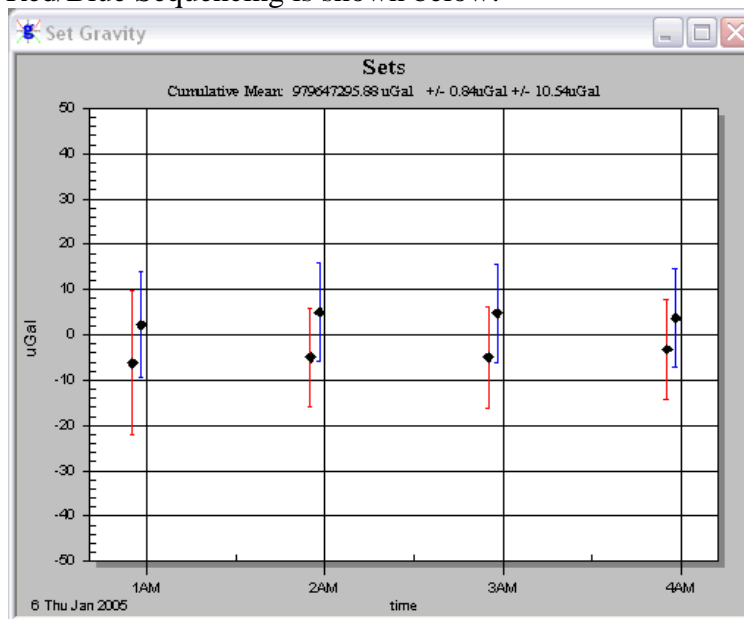
Control

The following information may be set from the Control Page

General Terms[15]

- Barometric Pressure - applies barometric pressure correction.

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[15] General Terms defined in Processing and Control

- Polar Motion – applies polar motion correction.
- Reference Xo – applies reference Xo correction.
- Datum Height – applies datum transfer correction.

Tidal Terms[16]

- Berger – applies standard earth tide correction.
- ETGTAB – applies advanced earth tide correction.

System Response[17]

Applies a system response correction.

Laser

- WEO
  - o "Automatic Peak Detect" determines the locked peak by checking the input voltage on the Patch Panel Laser input channel.
  - o "Modulation Frequency" includes the modulation frequency entered in the System Laser Setup page in the equation of motion. This option should ALWAYS be selected when using a WEO laser.
- AL-1/ML-1
  - o "Alternate" instructs the software to alternate between the "Blue" and "Red" lock settings of the AL-1 or ML-1 laser.

Seismometer

If data is taken from an FgL meter enabled with the seismometer option (FgLS), this box can be checked to apply the seismometer signal. The compensated signal is determined by integrating the seismometer velocity and subtracting the result from the trajectory. This option is only valid with the FgLS option. This option should be used carefully in Real-time mode as it takes substantial processing time. In general, drop rates should be set to 15s or greater if Seismometer Compensation is enabled for Real-time acquisition.

Drop Fit

Default parameters for an FG5 are

- Start Time = 35 ms
- Stop Time = 200 ms
- Start Fringe = 19
- Total Fringes = 601

These parameters can be varied for users wishing to experiment with the absolute value of gravity.

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[16] Tidal Terms defined in Explanation of Tidal Terms
[17] System Response correction defined in Processing and Control

Fit Sensitivity

As described above, Fit Sensitivity allows the user to determine the change in the calculated gravity value as different portions of the drop fit are selected. By default, a few milliseconds around the start time and stop time are plotted. Typically the gravity value should be constant within a few μGals.

- Top Start – Start time for the Top Fit Sensitivity.
- Top Stop – Stop time for the Top Fit Sensitivity.
- Bottom Start – Start time for the Bottom Fit Sensitivity.
- Bottom Stop – Stop time for the Bottom Fit Sensitivity.

Statistics

This section was discussed above in Processing Control and Gravity Corrections. In general, it is recommended to accept the *g* default numbers for the instrument specified.

Comments

Users may enter up to 100 lines of field or processing notes in this section.

Tide Correction Models

g software accommodates two Tide Correction methods, Berger and ETGTAB. Within each it is possible to incorporate an Ocean Loading model. Most users will find it sufficient to use the Berger method. However, to achieve µGal level accuracy, ETGTAB should be used.

g software also provides a tool to compute the ocean loading tides[18]. The amplitude and the phase of the gravity loading are computed using the Farrell's method. The Green's functions for the PREM model are used and a correction for the mass conservation is included. The users may choose different ocean tides models. Details of the choices and options are discussed below.

Berger

In the Berger correction, the tidal parameters are set using a constant delta factor of 1.1554 and a phase Kappa of zero. This delta factor cannot be modified except for the DC term (Honkasalo correction). The tidal potential is also set once for all.

The gravity body tide is computed and applied to the observations (each drop).   The program used for this computation was originally written by Jon Berger, November 1969, and was modified by J. C. Harrison, Judah Levine, and Karen Young, University of Colorado; Duncan Agnew, University of California San Diego (IGPP); and Glenn Sasagawa, NOAA.

ETGTAB

If ETGTAB is selected from the drop down list box, the SETUP button leads to the menu shown in Figure 12. The SETUP dialog has three separate sections. For more advanced information you can contact Olivier Francis at (Olivier@ecgs.lu).

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[18] For details see O. Francis and P. Mazzega, Global charts of ocean tide loading effects, journal pf geophysical research, 95, 11,411-11,424, 1990
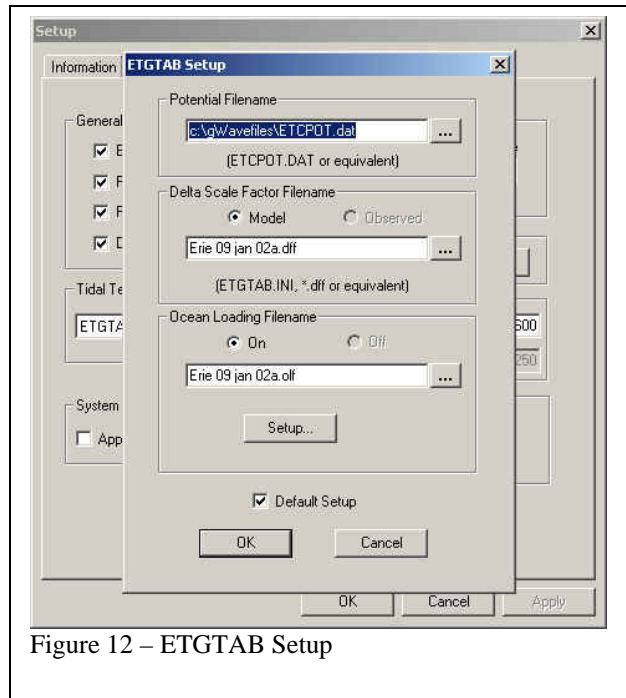
Figure 12 – ETGTAB Setup

Potential Filename

The first section allows the user to enter the Tidal Generating Potential File. For most users this file is called ETCPOT.dat and is located in the gWavefiles directory. The default file contains Tamura's potential

Tidal Parameters Filename

This file can be supplied by the user, or generated on the fly as discussed earlier.   The format of the file is shown in Figure 13. The default setup for *g*, enabled by checking the "Default " box, is for a "dff" file generated by the Oceanload (Model). This setup does NOT contain any ocean loading component[19]. If the user has a compatible model or observed tidal parameters for the gravity station, the "Default" button may be unchecked and, if applicable, the "Observed" radio button checked.

NOTE: An "Observed" Gravimetric Delta and Kappa Factors File contain the Ocean
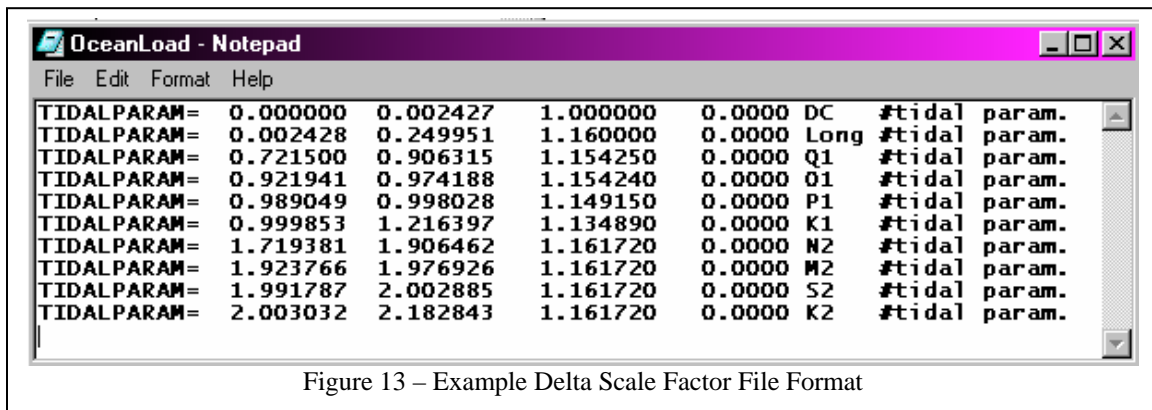
Figure 13 – Example Delta Scale Factor File Format

Loading component and therefore the Oceanloading Filename option is disabled automatically.

OceanLoad

Previous versions of *g* came with a separate tool for calculating OceanLoading. Two files are created by the OceanLoad tool:
- Delta Factor File – "oceanload.dff". This ASCII text file contains the listing of start frequency, end frequency, the Delta factor amplitude and phase (in degrees) in a format compatible with ETGTAB. This file can ONLY be used with the ETGTAB option.
- Ocean Loading File – "oceanload.olf". This ASCII text file contains the ocean load parameters (Wave, Amplitude and Local Phase listing). The file has an "olf" extension by default and can be used with Berger OR ETGTAB options.

It is recommended that the base name "oceanload" be modified to something unique for the current instrument location. For example, "oceanload-TMGO" can be used to indicate files for Table Mountian. This helps avoid the situation in which the ocean load files for a different location are accidentally used in the calculation (resulting in the wrong gravity value!)

g will use the information from the "Information" page to get all the data that it needs to create the OceanLoading files. The values it uses are…

- Name – Site name for the *g* project file.
- Latitude – Latitude of the site.
- Longitude – Longitude of the site.
- Elevation – Mean Sea Level elevation for the site.

The ocean tide files are supplied to Micro-g by Dr. Olivier Francis, http://www.ecgs.lu.

ADVANCED USERS

"SETUP" allows the selection of three common ocean tide model for each term :
- Schwiderski
- CSR3.0
- FES92

Users unfamiliar with these wave file models should accept the default values.

g allows users to use already existing OceanLoad files or it can dynamically create the necessary files that the user specifies on the fly. To use existing files, enable OceanLoad by clicking the check box in the SETUP option, and then search for the specified .olf and

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[19] Phase Kappa is set to Zero

.dff files. Or, to dynamically create the files, enable OceanLoading, and then pick an base name for the OceanLoad files. Then, when *g* is run for the first time, it will ask to create the specified files.

Oceanloading Format

As discussed above, depending on the information (modeled versus observed) contained in the tidal parameters file, an Ocean Loading file may or may not be entered. The format of the Ocean Loading file is shown in Figure 14. Users may generate this file using the OceanLoad tool as explained above, or from their own data source.

Figure 14 – Example Ocean Loading File Format

Additional Menu Options

Project

New

This option creates a new project file from scratch. All parameters are default and users MUST change the options according to their setup location, instrument and system[20], data acquisition parameters and control parameters.

Open

This option opens an EXISTING *FG5 file.

Close

This option close the current *FG5 file.

Save

This option saves the current *FG5 file

Save as Project

This option allows you to save a COPY of the current *FG5 file to disk, marking the file as REALTIME (as opposed to Post Mission). The current *FG5 file is closed and the COPY is opened.

Save as Template

 This option allows users to write a COPY of the current project file to disk, marking the file as a *GTF. These files are usually not edited, and the user cannot acquire data with a *GTF file.   *GTF files are meant to be used for creating new *FG5 files or other *GTF files.

Edit

Reset

This option allows users to reset all or some of the project file parameters to the values at the time of original data acquisition.

Time Offset

This option allows application of a time shift in the event that the computer time was not set to the correct time. To calculate the offset, change the "True Start

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[20] This includes Factory Height of theSystem ~~...~~ ation frequency is applicable (WEO).
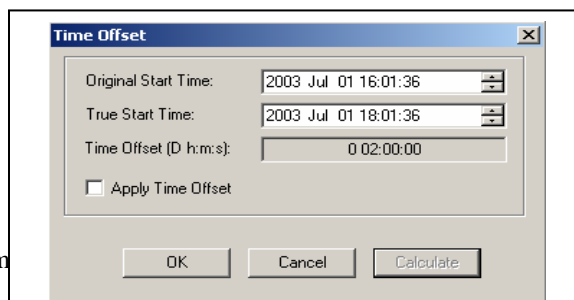
Figure 14 – Reset Time Offset Menu

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Time" to the correct time (the time that should have been) and then press "Calculate". Check the time offset as listed in the grayed edit box. If the time offset is correct, check the Apply Time Offset option to make the time offset effective during processing.

Process

Rate

This option sets the rate at which drops are processed in Post-Mission mode only. On some machines with slower graphics, it MAY be necessary to set the rate to 50ms or greater in order to avoid synchronization problems occurring between mathematical processing and graphical display.

Set Break Point

This option allows the manual setting of a break point in Post-Mission mode only. In general it is much easier to set a break point from the tree menu.

Go

This option starts the processing in both Post-Mission and Real-Time

Step

This option allows users to view process drops step by step in Post-Mission mode only.

Break

This option allows user to Pause processing and should only be used in Post-Mission mode.

Stop

This option stops all processing in Post-Mission processing or Real-time data acquisition.

Quick Update

This option is enabled AFTER all sets have been processed. If a users wishes to discard Sets to be included in the final determination of the absolute value of gravity, after the sets are deselected on the tree, Quick Update will update the project number according to the last setup of processing parameters. If ANY processing parameters change, Quick Update automatically reprocess ALL selected sets.

View Channels

This option allows users to view data channels before and after processing. This is useful since users sometimes would like to know what data is coming in from channels with out having to process any of the data.
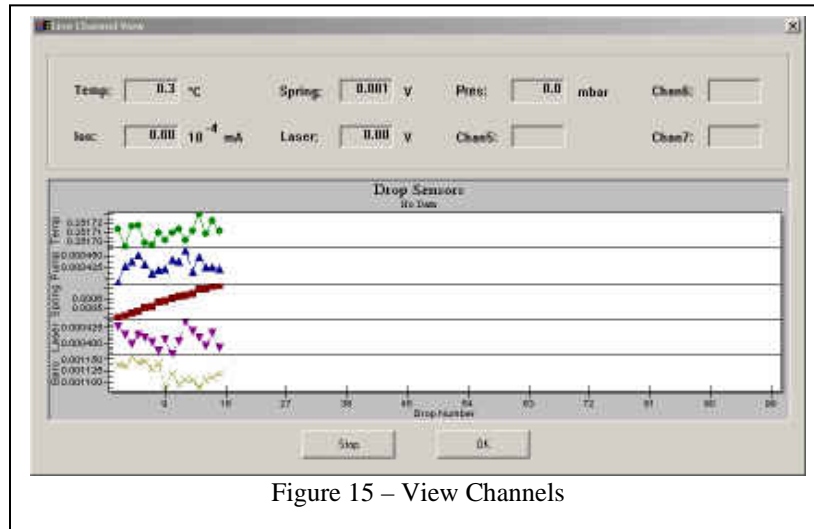

Figure 15 – View Channels

Options

Currently the only option under Options is *Graphics*. This option allows users to manually set all scales in the graphs. Graphical scales are saved to the project file. The user can also enable or disable "Data Review" mode. Data review, when enabled, allows users to click on a particular drop or set in the tree view, and view the last data that was stored. For Data Review mode to work properly, this option must be enabled BEFORE processing the data.

Output

There are three options under Output, Text, Raw Dump, and Graphics. By default, *g* outputs a text file for Project Summary and Set by Set Summary. If users wish to have additional information output to file (Drops, Graphics (.jpg image of the displayed view), or Raw Data), these options must be selected BEFORE processing the data. Note: The view must be opened for *g* to save the graphical images.

Utilities

g installs one additional utility onto the hardrive called Convert.   In addition to this, users can install "gToolBag". "gToolBag" is a set of three useful tools that user may want to use called gProjectMerge, gProjectCopy, and gToASCII.

Convert

Convert is the utility used for converting files obtained with Olivia DOS software into the new *g* format. Figure16 shows the Convert menu.

- Input File Path Name – This is the name of the DDT or compatible binary absolute gravity data file. *g* Convert supports most DDT files but may not support some versions. If you have trouble converting files, please contact MGS immediately.
- Freefall Project Name – This is the base name to be used with the *g* project file.
- Output Project Directory – This is the location at which all *g* converted files (FG5 and *.gsf) will reside.
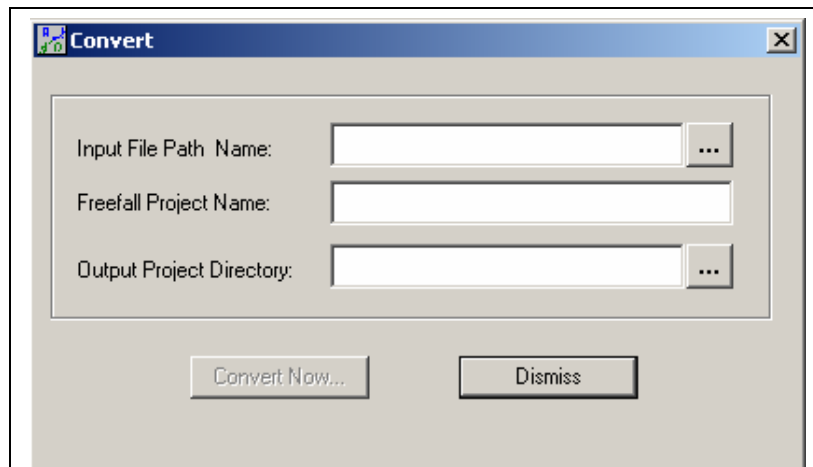

Figure 16 – Convert Utility

gToolBag

To install "gToolBag", run "gToolBagSetup.exe" which is located on the *g* installation CD. Follow the onscreen instructions until completion. "gToolBag" can be ran from the "Start"

gProjectMerge

gProjectMerge is a program that lets users combine many sets into one singe project file. This is useful for when many observations are done for one single geographic point. Figure17 shows gProjectMerge.

- Output Directory – This is the location where the merged project will reside.
- Final Project Name – This is the name which the merged project will be saved as.
- Merge Files – These are the files that will be merged together to create the merged project.
- Add File Button – This button is for adding more files to the "Merge Files" list.
- Remove File Button – This button is for removing files from the "Merge Files" list. This button will remove the selected item. If no items are selected it will remove the first item.
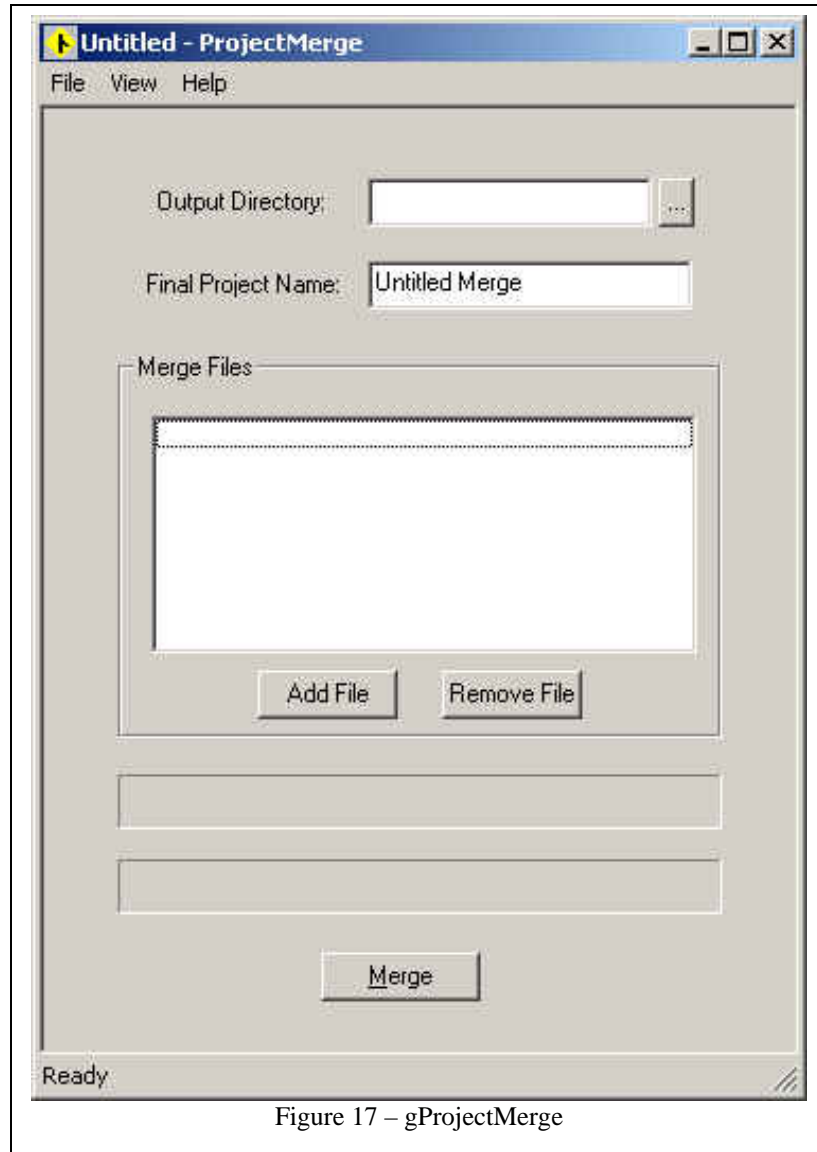- Merge Button – This button is used to start merging the file.

Figure 17 – gProjectMerge

gProjectCopy

gProjectCopy is a program that lets users easily change the name of their projects. This is useful if the user entered the wrong name for a project and needs to change it later. Figure 18 shows gProjectCopy.

- Input File – This is the file which the user wants to copy.
- New Project – This is the name of the output project name.
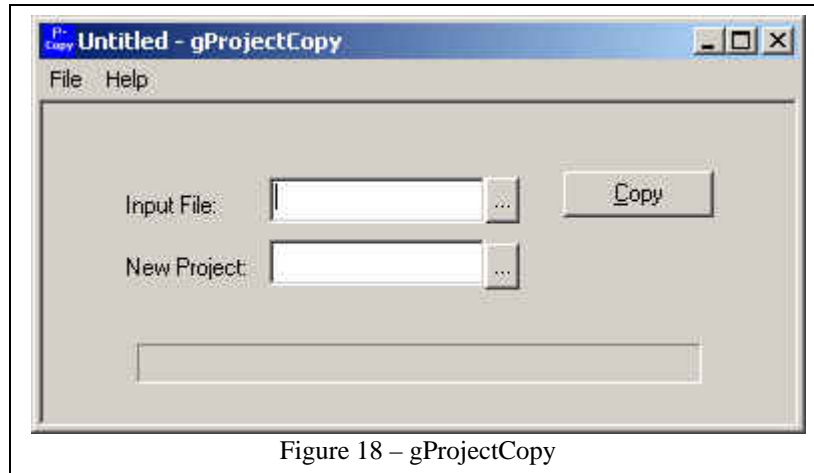- Copy Button – This button starts the copying process.

Figure 18 – gProjectCopy

gToASCII

gToASCII is a program that allows independent ASCII archiving of raw *g* data (for other software programs and long term storage purposes). Figure 19 shows gToAscii.

- Input File – This is the file which the user wants to extract data from.
- Output File – This is the name of the output text file.
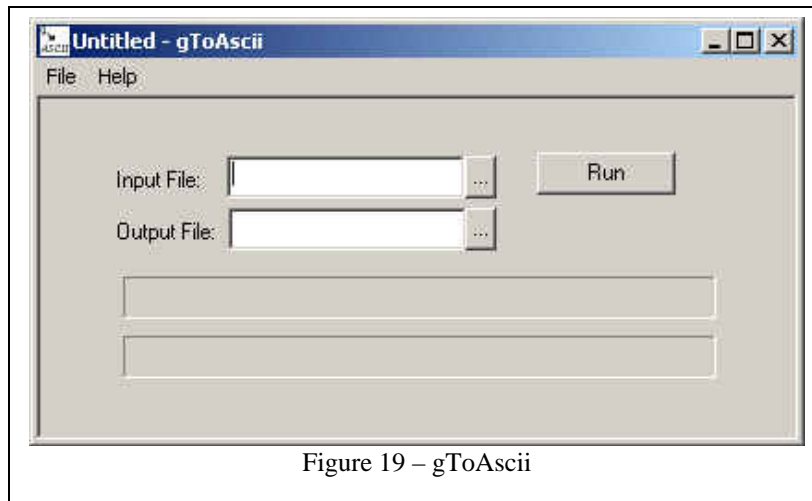- Run Button – This button starts the extraction process.

Figure 19 – gToAscii

License Information

Licensed users of *g* are entitled to three install platforms with the Main License. Additional installations, including support, are purchased one seat at a time directly from Micro-g. If your institution or company requires *g* to run on more than three platforms, please contact MGS directly or visit our website, www.microgsolutions.com, for more information.

Support

Questions concerning the operation of *g* software and any problems using *g* should be directed to:

microg@microgsolutions.com

You can expect to receive an email or phone call within forty eight hours of your inquiry.

Maintenance

Periodically MGS will post an upgrade "patch" for *g* on the website. These patches will be posted without notification so please check back every few weeks to get the latest patch if applicable.