Gravity import file formats (R27)

In this chapter:

AGSO import file format

A single flat ASCII file structure. Has the advantage that all the data is in one place and will survive the test of time for archival purposes. All data including positions, control stations and calibrations are included in this file. Examples of the AGSO format can be found in your INTREPID installation in **sample_data/cookbooks/ gravity/land/AGSO_Week1&2.DAT**.

Description

The import file consists of lines of text describing gravity stations and the sequence of readings taken at them.

The lines of the contain a number of fields separated by commas.

Lines commencing with the keywords **SURVEY**, **POSITION**, **GRAVITY**, **GRAVIMETER** determine the structure of the file. These lines identify and contain data common to blocks of individual station data or readings. Each individual reading or station specification is on a separate line following one of these keyword lines.

Lines starting with # are comment lines. INTREPID ignores them. You can force INTREPID to ignore a line by placing a # at the start.

Note: For an example of calibration data, see Gravimeter calibration (R29)

Here is part of a gravity import file:

An example import file

```
SURVEY,9604,Cobar Detailed Traverses - New South Wales
#
# Gravity Stations
#
POSITION,UNKNOWN,ANS,AGD66,AHD,GEODETIC,0.000001,0.020
96040001,146:3:7.34588,-31:31:26.36739,252.996
96040002,146:2:52.65521,-31:31:24.67920,244.491
96040003,146:2:37.63321,-31:31:22.87273,241.373
      ...
#
# Control Gravity Stations
#
POSITION,UNKNOWN,ANS,AGD66,AHD,GEODETIC,0.0001,0.1
50999943,145:50:06,-31:30:06,241.06
64910143,145:47:54,-31:32:30,217.98
      ...
#
GRAVITY,ISOGAL84
80900143,9793892.6,0.1,Cobar Airport Terminal
64910243,9793834.0,0.1,Cobar PM4917
         ...
```

```
#
GRAVITY,ISOGAL65
50999943,979396.20,0.01,Cobar Police Station
64910143,979403.15,0.01,Cobar Airport on Sign
           ...
      ...
#
# Gravity Survey Data
#
GRAVIMETER,LCR_G,G132,HReith,1.000214
#
LOOP,323.01,+11
80900143,1996,11,18,08:17:00,2925.549,+0.000,0.0,0.0,0.0,BAR AIRPORT
96042009,1996,11,18,13:23:00,2912.391,+0.000,0.0,0.0,0.0,
96041000,1996,11,18,13:43:00,2912.052,+0.000,0.0,0.0,0.0,
      ...
80900143,1996,11,19,19:12:00,2925.477,+0.000,0.0,0.0,0.0,
#
LOOP,325.02,+11
80900143,1996,11,20,08:05:00,2925.448,+0.000,0.0,0.0,0.0,
96041105,1996,11,20,08:53:00,2927.949,+0.000,0.0,0.0,0.0,
      ...
80900143,1996,12,01,16:13:00,2925.026,+0.000,0.0,0.0,0.0,
      ...
#
#
GRAVIMETER,LCR_G,G101,PWynne,1.002932
#
LOOP,324.01,+11
80900143,1996,11,19, 7:59:00,2866.978,+0.000,0.0,0.0,0.0,x cobar a/p
96229601,1996,11,19, 9:04:00,2852.896,+0.000,0.0,0.0,0.0,called 9601 in gps
MERYULA
96040001,1996,11,19, 9:08:00,2852.179,+0.000,0.0,0.0,0.0,hill curve
96040002,1996,11,19, 9:12:00,2853.598,+0.000,0.0,0.0,0.0,
                  ...
```

Structure of the import file

The following table describes these fields. For lines commencing with a keyword, the keyword is field 1, so the remaining fields commence at number 2.

Keyword	Field	Field Description	Example or Possible values
`SURVEY`	1	Survey header	
	2	Survey number	`9604`
	3	Descriptive title	`Cobar Detailed Traverses -NSW`
`POSITION`	1	**Gravity station definition**	
	2	Coordinate reference	
	3	Ellipsoid	`ANS`
	4	Datum	`AGD66`
	5	Height datum	`AHD`
	6	Projection	`Geodetic`
	7	Position accuracy (distance units: or m)	`0`
	8	Elevation accuracy (m)	`0.02`
`station number`	1	Station number	`96040001`
	2	Longitude or X coordinate	`03:07.3`
	3	Latitude or Y coordinate	`-31:31:26.36739`
	4	Altitude (m)	`252.996`
	5	Name of station	`Boyles tank`

`...`

(More station positions)

`...`

(More station position blocks)

Keyword	Field	Field Description	Example or Possible values
`GRAVITY`	1	**Control Gravity Reference**	
	2	Gravity datum	`Potsdam, ISOGAL65,` `ISOGAL80, IGSN71`
`station number`	1	Station number	`80900143`
	2	Control gravity value	`9793892.6`
	3	Accuracy of gravity value	`0.1`
	4	Name of station	`Cobar Airport`

`...`

(More control stations)

`...`

(More control station blocks)

Keyword	Field	Field Description	Example or Possible values
`GRAVIMETER`	1	**Gravimeter Loop Set**	
	2	Gravimeter type	`Scintrex` `LCR_G` `LCR_G_AFFB` `LCR_D` `LCR_DD` `LCR_DD_MVR   *`
	3	Gravimeter number	`G132`
	4	Observer	`HReith`
	5	Nominal scale factor	`1.000214`
`LOOP`	2	Loop number	`323.01`
	3	Time difference from UST	`11`

Keyword	Field	Field Description	Example or Possible values
`station number`	1	Station number of reading	`80900143`
	2	Year	`1996`
	3	Month	`11`
	4	Day	`18`
	5	Time (fraction of day)	`0.345138889`
	6	Dial reading	`2925.549`
	7	Digital voltmeter reading (This is used for fine adjustment. INTREPID applies a scale factor depending on the meter type and adds the result to the dial reading.)	`0`
	8	Distance from top of meter in mm (delta H)	`0`
	9	Barometric pressure	`0`
	10	Temperature	`0`
	11	Comments	`between large trees`

...

(More readings)

...

(More loops)

...

(More gravimeters)

Keyword	Field	Field Description	Example or Possible values
`CALIBRATION`	**1**	**Calibration Data For Gravimeter**	
	2	Gravimeter type	`LCR_G`
			`LCR_G_AFFB`
			`LCR_D`
			`LCR_DD`
			`LCR_DD_MVR`
	3	Gravimeter number	`G132`
	4	Observer	`HReith`
	5	Nominal scale factor	`1.000214`
`CALRUN`	2	Calibration loop number	`323.01`
	3	Time difference from UTC	`11`

Keyword	Field	Field Description	Example or Possible values
station number	1	Station number of reading	**80900143**
	2	Year	**1996**
	3	Month	**11**
	4	Day	**18**
	5	Time	**0.345138889**
	6	Dial reading	**2925.549**
	7	Digital voltmeter reading (This is used for fine adjustment. INTREPID applies a scale factor depending on the meter type and adds the result to the dial reading.)	0
	8	Distance from top of meter in mm (delta H)	0
	9	Barometric pressure	0
	10	Temperature	0
	11	Comments	**between large trees**

...

(More readings)

   ...

(More loops)

...

(More gravimeters)

* Contact our technical support service if you require support for other gravimeters.

Scintrex import file format

Import file overview

This format requires three files:

- Gravity data from the meter. The data for the CG3 and CG5 are in different format. See:
    - Gravity data from meter (CG3)
    - Gravity data from meter (CG5)
- Formatted GPS position data
- Control station information

Examples of the Scintrex CG3 format can be found under the INTREPID installation in **sample_data/cookbooks/gravity/land/SCINTREXAMPLE1.DAT, SCINTREXAMPLE1.GPS, SCINTREXAMPLE1.ABS**.

Earth tides are always removed from the meter data and re-calculated by INTREPID.

Gravity data from meter (CG3)

For CG3 the data file is in ASCII format. These files have the extension **.DAT**

Line 0 is reserved for special use to capture base station readings on any one day. If you use a Line 0, the basestations do not need to be included in the loop records. The loop is reconstructed by looking at the time, day etc. Line 0 must be first in a sequence.

Alternatively, loops are constructed by using the Line number as a Loop number. If the Line number, Meter number and day are identical on blocks of data, it is assumed that the data all forms part of the same loop.

Gravity data from meter (CG5)

For CG5 the data file is in binary format (**.sgd** file)

Under **File** there is a **Dump/Check** option which will convert the binary *.sgd file to an ASCII file. This allows the user to review the various survey record headers in the data, in the event that the meter contains data from different surveys.

Intrepid supports the import of multiple *.sgd files via a list of survey files.

Formatted GPS position data

These files have the extension **.GPS**)

The GPS file must have a header containing standard field names. It is optional to give a LINE number. If you do, you produce a line or profile database rather than a random point data base.

Station must correspond with the Gravity station number in the data file. You can enter either geodetic or projected coords in Scintrex format.

Examples of GPS files:

```
NAME   LATITUDE   LONGITUDE   HEIGHT

1321 -37.75000000 148.45000000 100.000

    9 -37.64748908 148.06730520 112.710
```

```
            Station Easting  Northing Elevation

            14   463244.316  5770311.886 77.386

            15   463272.101  5770323.312 76.829

            16   463299.808  5770334.751 76.198
```

Control station information

These files have the extension **.ABS**

The Control station file has the following format:

Station number, tie-in observed gravity (Absolute), Datum

You can have as many control stations as you like.

Example of Control Station file:

1000   979269.241   IGSN71

11000   979269.241   IGSN71

The units are the same as chosen in the Mode box.

Gravity observation data file for SC3 (**.DAT**)

This file contains the gravity data as recorded.

Example

```
SCINTREX V5.0           AUTOGRAV / Field Mode            R4.4
                                       Ser No:           610353.
Line:  9750.E  Grid:     1.  Job:      892.  Date: 98/02/05  Operator:      1.


GREF.:                        0. mGals      Tilt x sensit.:          266.5
GCAL.1:                6400.428             Tilt y sensit.:          276.3
GCAL.2:                      0.             Deg.Latitude:            -30.8
TEMPCO.:               -0.1235 mGal/mK      Deg.Longitude:          -119.5
Drift const.:                0.55           GMT Difference:          -8.hr
Drift Correction Start  Time: 11:40:40      Cal.after x samples:        12
                        Date: 98/01/26      On-Line Tilt Corrected = "*"
--------------------------------------------------------------------------
Station  Grav.     SD.    Tilt x  Tilt y   Temp.   E.T.C.  Dur  # Rej    Time
 1000.N 4205.608* 0.047      -0.      1.    0.06    0.070   40     0  10:00:41
 1025.N 4205.540* 0.053       5.     -2.    0.06    0.069   40     0  10:03:28
 1050.N 4206.589* 0.044      -1.      4.    0.06    0.068   40     0  10:06:35
 1075.N 4207.339* 0.054       3.     -4.    0.05    0.067   40     1  10:08:37
 1100.N 4207.744* 0.041       0.      2.    0.05    0.066   40     0  10:10:26
 1125.N 4207.791* 0.049       2.     -1.    0.06    0.065   40     0  10:13:00
 1150.N 4207.725* 0.046       2.     -1.    0.05    0.064   40     0  10:16:06
 1175.N 4207.617* 0.042      -7.      4.    0.05    0.063   40     0  10:18:25
 1200.N 4207.479* 0.052      -1.      8.    0.05    0.061   40     0  10:21:02
 1225.N 4207.466* 0.054      -2.      3.    0.05    0.061   40     0  10:22:45
```

File header format

```
SCINTREX V5.0            AUTOGRAV / Field Mode                    R4.4
                                            Ser No:        610353.
Line:  9750.E  Grid:     1.  Job:      892.  Date: 98/02/05  Operator:      1.
```

Field	Description
Ser No	The serial number of the gravimeter. INTREPID uses this to define a GMLS.
Date	Day, month and year of the gravity station reading .
Line	INTREPID uses this field if the Gravity station location file (**.GPS**) file uses it (See "GPS data input" below)
Grid	INTREPID does not use this field
Operator	Operator number.
	We recommend that you document the name of the operator associated with this number. You can replace the number with the operator name in the processing report using a text editor if required.

Gravity da\ta format

Station	Grav.	SD.	Tilt x	Tilt y	Temp.	E.T.C.	Dur	# Rej	Time
1000.N	4205.608*	0.047	-0.	1.	0.06	0.070	40	0	10:00:41

Field	Description
Station	Station number field .
	We recommend that you follow the four digit AGSO convention. A maximum of five digits is possible for the station number . Do not use zero as the first digit. The Scintrex gravimeter will place a decimal and letter after the digit survey number following its line naming convention . INTREPID only imports the four digit number.
Grav	Dial reading of the Scintrex gravimeter in mGal. ***** is present when the tilt correction parameter is set (consult the CG3 operators manual for details.). INTREPID ignores this symbol.
SD	If there is only one reading for the station, INTREPID uses this value to report error and calculate the observed gravity error (**obsgerror**) field in the dataset. If there are several readings, INTREPID ignores this field.
Tilt x, Tilt y, Temp	INTREPID does not use these fields
ETC	The Scintrex meter can automatically apply an Earth tide correction (ETC.) to the dial reading (consult the CG3 operators manual for details.) If the gravimeter applies this correction INTREPID removes it and applies its own Earth tide correction
Dur, # Rej	INTREPID does not use these fields
Time	Time of gravity reading. INTREPID converts hours, minutes, seconds format into hours.

Gravity station location file (**.GPS**)

This file contains station number and location for each survey gravity station and control base station.

You may only have one record per station in this file. If you have multiple GPS readings, edit the file to remove the duplicates.

Example

```
line  stationeastingnorthingelevation
9750  1000  743550.401 6584501.617394.38
9750  1025  743570.723 6584515.289394.97
9750  1050  743590.142 6584529.848390.76
9750  1075  743611.931 6584542.455388.19
```

Format

The first line of this file defines the import fields. For example:

> **line name longitude latitude height**

or

> **line name easting northing height**

The fields are separated by free spaces. The columns may be in any order. The blocks of data must follow the order shown in the header line.

The following table gives a description of each field.

Field	Description
line	Set this field to the survey number (See "GPS data input" below)
name	Station number (identical to the four digit station number in the gravity observation data file)
longitude latitude	Coordinates of the gravity station (geodetic data) These can be in decimal degree format or *degree:minute:second* format.
easting northing	Coordinates of the gravity station (projected data). You must specify the projection in the Gravity tool during import. INTREPID converts the data to geodetic.

Network control station file (**.ABS**)

This file defines the network control station data

This can be:

- An absolute station where the absolute gravity value has been determined by pendulum or interferometry experiments or
- A network control station with value relative to some standard or an arbitrarily assigned value.

Example

> **80999998   9793892.6 ISOGAL80**

Format

INTREPID uses the station on the first line as the network control station. Any stations on following lines are for reference or for use in other work (by editing the file to bring them to the top).

The fields are space-delimited and there is no first line with field names.

The data has the following format:

stationnumber   controlstation   datum

Field	Description
stationnumber	Station number (identical to the corresponding four digit station number in the gravity observation data and gravity station location file).
controlstation	Gravity value for the station in the same units as the gravity observation data file
datum	Gravity datum for the station data

*Tip: Note: the **datum** field here is the only way of specifying the theoretical gravity model for the data.*

Scintrex import file notes

Preparing Scintrix data import

Prepare the Scintrex import files as follows:

1   Ensure that you have unique 4-digit station numbers.

2   Set the Line field to the survey number

Note:

· INTREPID ignores some fields in the gravity observation data file. See the Scintrex CG3 Autogravimeter manual for a full explanation of this file.

· As you acquire more survey data over the course of the survey you can incorporate it into the gravity dataset. Append each additional Scintrex file to the previous file using a text editor.

Gravity import data

Just dump the data straight from the meter. Can cope with different versions of the meter. (for example, V 4.7, 5.2)

Each group of data has a header that includes

Line, User, Meter Number, Date.

For a given line, Meter, Date and User, if there are multiple groups, these are concatenated into a logical loop for the current gravity meter loop set.

Lines Nos 1–9 are reserved for Base Station observations or to tie into the AGSO network.

These readings are detected on input and concatenated around the gravity line data for the same date. Up to 9 base-in/outs are supported for the same day using this convention.

Grid style survey design

This is supported where Line Number is usually North–South co-ordinate and Station number is East–West.

The Program currently ignores N–S and E–W annotations, except for reporting.

GPS data input

Must supply GPS locations for all stations except fixed nodes and base IN/OUT nodes for a loop.

This is a free format, multi-column ASCII file that has a mandatory header.

Three normal conventions for the header labels are:

```
Station Easting Northing Elevation
Station longitude latitude Elevation
Station line longitude latitude Elevation
```

Where Station and Line can be interchanged and either Easting and Northing or longitude and latitude can be interchanged:

- If the Station Line convention is used, the user is assumed to be following a 'grid-style' gravity survey. Where Station is E-W, line is N-S.
- If station-only GPS data convention is used, the station number is derived by the Gravity line ✱ 10,000 + station number.

For example, Line 9750, Station 1000 becomes station 97501000 for the GPS data and for internal processing.

INTREPID lists line and station separately in "16: Final values" in Gravity corrections (T54).

Tie-In to National Grid Data

A GPS data record is edited to create the tie-in link to an AGSO or National Grid, where an absolute or control value is available.

This accomplished using an optional addition to the station. A convention of aliasing an AGSO-style station number after a slash is used. for example, **1570/956359**

The first number is the internal station number. The number following the slash is the AGSO-style station number for the same location. This is supported for all the GPS data input variations.

The required control stations values can be input using the third ASCII file.

The convention is **Station, Value, Gravity Datum**, one observation per record in free format. For example:

```
88001236    975630IGSN71
93216321    977544IGSN71
```

Other Issues

Treatment of internal loop repeat readings. It is now optional to use reports to make adjustments to the short term linear drift.

Calibration

The concept of calibrating or checking the calibration of a Scintrex meter is more complicated than for the older style LaCoste & Romberg meters. The Intrepid calibration option is geared for the L & R first order correction. It is more usual to follow Scintrex's recommended calibration procedures, and re-calibrate the instrument on a range and store the first order fixes internal to the meter.