

## PBO Raw Strainmeter data: Bottle Files

### 1. Bottle format

GTSM21 dataloggers collect strain data in bottle files. Bottle files are binary files that consist of a 40-byte header followed by the strain data. If the data logger fails to make a measurement at a particular time that data point is given the value 999999. Bottle files are therefore continuous in time. All bottles collected by the data logger are in little endian format.

Bottle header structure		
Bytes	Data Type	Description
0-1	short	magic number (15D Hex)
2-3	short	unused
4-7	integer	size of header (40 bytes)
8-15	double	start time, expressed as seconds since 1 Jan 1970
16-19	float	sample interval in seconds
20-23	integer	number of data points in the file
24-27	integer	data type: short, integer, float
28-31	integer	invalid data point, 999999
32-35	integer	unused
36-39	integer	bottle identifier

### 2. Archived Bottle files

The raw bottle files downloaded from the GTSM21 data logger are archived at the IRIS Data Management Center and the Northern California Earthquake Data Center. Other than tarring the files for transfer via LDM, no changes are made to the bottle files.

The archives store three tar files for each station for each day of the year:

- SSSSYDDDDay.tgz 10-minute strain data and diagnostic data
- SSSSYDDD\_01.tar 1 sample-per-second (sps) strain data
- SSSSYDDD\_20.tar 20-sps strain data,

where SSSS is the four-character strainmeter code, YY represents the last two digits of the year and DDD represents the day of the year. For example, the three tar files from strainmeter B004, day 261 of 2005 would be B00405261Day.tgz, B00405261\_01.tar and B00405261\_20.tar.

#### 2.1 The Day File: SSSSYDDDDay.tgz

The Day file contains 10-minutes interval strain measurements from each of the four strain gages plus lower sample rate diagnostic data. The following are the contents of a day file from a borehole strainmeter B004, year 2005 and day 261.

File	Description	Sample interval (mins)
B00405261BatteryVolts	Battery Voltage	30
B00405261CH0	Channel 0 strain	10
B00405261CH1	Channel 1 strain	10
B00405261CH2	Channel 2 strain	10
B00405261CH3	Channel 3 strain	10
B00405261CalOffsetCH0G1	Calibration Offset Channel 0 Gain1	60
B00405261CalOffsetCH0G2	Calibration Offset Channel 0 Gain2	60
B00405261CalOffsetCH0G3	Calibration Offset Channel 0 Gain3	60
B00405261CalOffsetCH1G1	Calibration Offset Channel 1 Gain1	60

B00405261CalOffsetCH1G2	Calibration Offset Channel 1 Gain2	60
B00405261CalOffsetCH1G3	Calibration Offset Channel 1 Gain3	60
B00405261CalOffsetCH2G1	Calibration Offset Channel 2 Gain1	60
B00405261CalOffsetCH2G2	Calibration Offset Channel 2 Gain2	60
B00405261CalOffsetCH2G3	Calibration Offset Channel 2 Gain3	60
B00405261CalOffsetCH3G1	Calibration Offset Channel 3 Gain1	60
B00405261CalOffsetCH3G2	Calibration Offset Channel 3 Gain2	60
B00405261CalOffsetCH3G3	Calibration Offset Channel 3 Gain3	60
B00405261CalStepCH0G1	Calibration Step Channel 0 Gain1	60
B00405261CalStepCH0G2	Calibration Step Channel 0 Gain2	60
B00405261CalStepCH0G3	Calibration Step Channel 0 Gain2	60
B00405261CalStepCH1G1	Calibration Step Channel 1 Gain1	60
B00405261CalStepCH1G2	Calibration Step Channel 1 Gain2	60
B00405261CalStepCH1G3	Calibration Step Channel 1 Gain2	60
B00405261CalStepCH2G1	Calibration Step Channel 2 Gain1	60
B00405261CalStepCH2G2	Calibration Step Channel 2 Gain2	60
B00405261CalStepCH2G3	Calibration Step Channel 2 Gain2	60
B00405261CalStepCH3G1	Calibration Step Channel 3 Gain1	60
B00405261CalStepCH3G2	Calibration Step Channel 3 Gain2	60
B00405261CalStepCH3G3	Calibration Step Channel 3 Gain2	60
B00405261DownholeDegC	Down hole temperature	30
B00405261LoggerDegC	Logger Temperature	30
B00405261PowerBoxDegC	Power Box Temperature	30
B00405261PressureKPa	Atmospheric Pressure	30
B00405261RTSettingCH0	Ratio Transformer Channel 0 Calibration	60
B00405261RTSettingCH1	Ratio Transformer Channel 1 Calibration	60
B00405261RTSettingCH2	Ratio Transformer Channel 2 Calibration	60
B00405261RTSettingCH3	Ratio Transformer Channel 3 Calibration	60
B00405261Rainfallmm	Rainfall mm	30
B00405261SolarAmps	Solar Amps	30
B00405261SystemAmps	System Amps	30

## 2.2 The 1-sps tar file: SSSSYDDDD\_01.tar

The SSSSYDDDD\_01.tar file contains 1-sps strain measurements from each of the four strain gages within the strainmeter. The tar file contains 24 SSSSYDDDDHH.tgz files where HH represents the hour. There is one file for each hour of the day. Each SSSSYDDDDHH.tgz file contains 4 bottle files:

- SSSSYDDDDHHCH0
- SSSSYDDDDHHCH1
- SSSSYDDDDHHCH2
- SSSSYDDDDHHCH3.

The 1 sps tar file therefore contains 96 individual bottle files.

## 2.3 The 20-sps tar file: SSSSYDDDD\_20.tar

The SSSSYDDDD\_20.tar file contains 20-sps strain measurements from each of the four strain gages within the strainmeter. Within the 20-sps tar file there are 24 individual tar files, one for each hour of the day, with the filename format SSSSYDDDDHH\_20.tar. Each of the SSSSYDDDDHH\_20.tar contains 60 gzipped tar files, one for each minute of the day (MM). The filename format for each of the minute tgz files is SSSSYDDDDHHMM\_20.tgz. Within each SSSSYDDDDHHMM\_20.tgz file there are four 1-minute long, 20-sps bottle files. The bottle filenames are of the format:

- SSSSYDDDDHHMMCH0\_20
- SSSSYDDDDHHMMCH0\_20
- SSSSYDDDDHHMMCH0\_20
- SSSSYDDDDHHMMCH0\_20.

The 20-sps tar file therefore contains 5760 individual bottle files.