DSG MANUAL

Digital Spectrogram Long-Term Acoustic Recorder

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Manual v2.1 (data format v 2000)

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Overview

Hardware

DSG is a low-power acoustic recorder designed to sample at rates up to 80 kHz continuously or on a duty cycle to Secure Digital High Capacity (SDHC) memory. The DSG also supports burst recording at sample rates up to 400 kHz. Data are saved in a DSG file format that can be downloaded to a PC for further analysis.

DSG recording is controlled by two script files on the SDHC card.
Default.txt controls overall recorder settings.
Sched.txt controls the scheduling of recording.
The DSG features power-saving features including sleep and wake cycles when performing interval recording.

Software

Two utilities are included on the installation disk and are also available on www.loggerheadinstruments.com. Double-click on DSGsetup.msi to install.

DSGSchedule can be used to create the Default.txt and Sched.txt script files. These files could also be created by hand.

DSG2wav is a utility that converts DSG files to wav files.

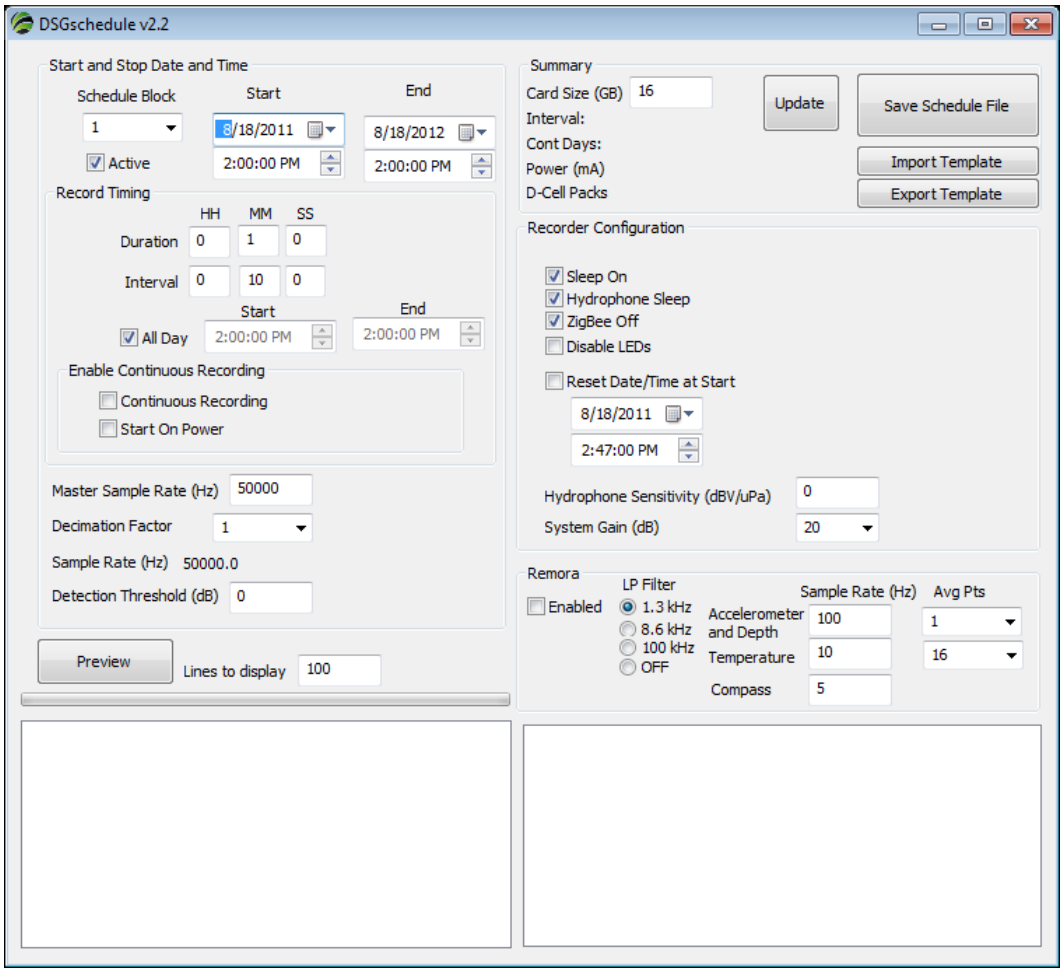
DSGSchedule Software

DSGSchedule Software Description

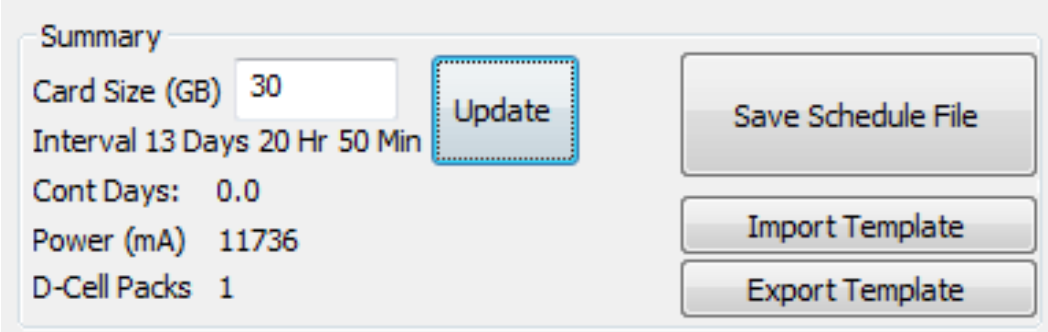
DSGSchedule is used to create the configuration (*Default.txt)* and schedule (*Sched.txt*) files for DSG. These are saved in a folder named 'Script' in the root directory of the SDHC flash memory card.

Default.txt contains the DSG recorder configuration (sample rate, sleep mode, date and time setting).

Sched.txt contains a list of dates and times of recordings.



Summary



Summary information is useful for developing recording schedules that optimize use of card space and battery power.

Click the **Update** button to calculate the Summary information. This will also show the entire default.txt and sched.txt files that would be created below. This can take a long time if the schedule is long.

Card Size (GB): Enter the Secure Digital card size in Gigabytes. Note that manufacturers are generous in how they describe card size. 32 GB cards are often smaller than 32 GB (e.g. 30.9 GB). This can be checked by examining the Properties of the card in Windows. It is always safer to underestimate the actual card size, because the script file also uses memory on the card.

Recommended Settings:
'16 GB': 15.5 GB
'32 GB': 30 GB

Interval: Estimate of the amount of time it will take to fill the memory of the card based on the schedule interval settings.

Cont Days: If continuous recording is enabled, will indicate number of days of continuous recording. Total record time is Interval + Cont Days.

Power (mA): Estimated power requirements until the SD card is filled.

D-Cell Packs: Estimated number of 3-D-cell packs needed for the power requirements. This estimate is made assuming D-cells provide 12 Ah. Note that under cold conditions, alkaline batteries will not last as long.

Update Button: Updates calculation of summary data.

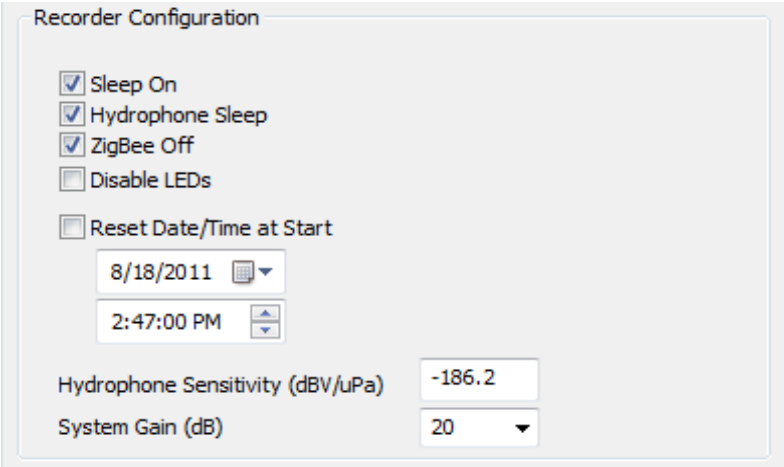
Saves Schedule File Button: Saves schedule files (Default.txt and Sched.txt) on Secure Digital card. Select the root directory of the SD card and the files will be created in a folder named Script (if a Script folder already exists, do not select this folder; save it in the root directory e.g. G: (or whatever drive your SDHC card is).

This operation could take minutes for long schedule files. Note, this operation does not update the Summary information.

Export Template: Saves DSGSchedule settings to a file (.sch). Useful for creating preset schedules that will be loaded multiple times.

Import Template: Loads DSGSchedule settings file (.sch).

Recorder Configuration



The Recorder Configuration is used to configure the settings in the *Default.txt* file.

Sleep On: When checked, DSG will sleep in between recording sessions. This saves power. DSG draws about 110 mA while running and 1-2 mA while sleeping.

Hydrophone Sleep: If checked, power to the hydrophone will sleep when the DSG sleeps. Only uncheck if you need to use the power to the hydrophone while the DSG is sleeping.

ZigBee Off: Turns off ZigBee communications at start to save power.

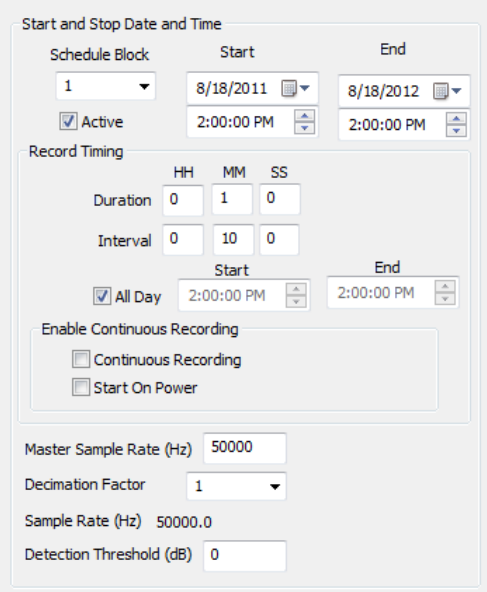
Disable LEDs: If checked, will disable LEDs after first recording. Disabling LEDs does not save much power, it is intended for situations where blinking LEDs would be problematic (such as deployments on animals).

Reset Date/Time at Start: When checked, the DSG will reset the internal real-time clock to the date and time specified in the drop-down boxes when power is applied to the DSG (and whenever the DSG is restarted). See section on Setting Date and Time. When this box is unchecked, the DSG will use the time on the internal clock. See the section of the manual on 'Setting the Date and Time'.

Hydrophone Sensitivity (dBV/uPa): Enter the calibration of the hydrophone. The hydrophone calibration is given on a printed sheet at the end of the manual. Contact Loggerhead Instruments if you do not know the calibration. This value is stored in the header of the data files.

System Gain (dB): Select the system gain. The default of 20 dB is recommended. The system gain works with the SC1 signal conditioning board. If the SC1 is not present, the DSG gain will be 20 dB (regardless of the setting in this box).

Start and Stop Date and Time



This configures the time and duration of recordings using schedule blocks. Each block can have its own timing configuration. The blocks are then combined to produce one *Sched.txt* file that is used by DSG.

Schedule Block: Select schedule blocks with the drop-down box. 10 Schedule Blocks are available. Check the Active box to make the schedule block active (i.e. the timing settings from active schedule blocks are used to make the *Sched.txt* file). By default only Schedule Block 1 is active.

Start/End: Used to set the overall start date and time and end date and time of the recordings for a given schedule block. Each schedule block can have its own start and end dates and times.

Record Timing

The record timing is used to set the duration and period of recordings. One file is created for each interval.

Duration*:* Duration of recording in hours (HH), minutes (MM), and seconds (SS).

Interval*:* Interval between start times of recordings in hours (HH), minutes (MM), and seconds (SS). The interval must be longer than the duration. This is NOT the time between the end of one file and the beginning of the next file.
All Day/Start/End: If the All Day box is checked, recordings will be made throughout each day at the specified interval. If the All Day box is not checked,

recordings will only be made for the part of the day specified by the Start and End times. This allows recordings to be made for just part of the day, such as at dawn.

Continuous Recording: If checked, files will be recorded continuously starting at the date and time indicated by the Start calendar drop-down. New files will be created every 2 MB. Once continuous recording is encountered in a schedule file, no other recording schedules will be processed.

If **Start on Power** is checked, the recording will start as soon as power is applied to the DSG. If Start on Power is not checked, the recording will start on the date and time specified by the Start section of this dialog box.

Master Sample Rate (Hz): Sample rate of DSG in Hz (samples/second). The DSG has a built-in low-pass filter ~30 kHz. The DSG supports a limited set of sample rates. The sample rate will be automatically adjusted to result in an acceptable sample rate, if an unsupported sample rate is entered.

The Master Sample Rate is the same for all blocks. So, if it is changed in one block, all blocks will be updated to this new sample rate.

Decimation Factor: Sets whether the recording is decimated prior to saving. The decimation routine implements a digital low-pass filter on the DSG prior to decimating to a lower sample rate. This is useful for avoiding aliasing of data stored with a low final sample rate. The decimation factor can be different for each blocks thus allowing multiple final sample rates within one schedule.

Detection Threshold (dB): Stores frames (4096 points) of data where signal is above the detection threshold. The hydrophone sensitivity and system gain are used to determine when the signal exceeds the detection threshold. If the detection threshold is set to 0, data are saved according to the schedule. Detection threshold is typically used with Continuous Recording.

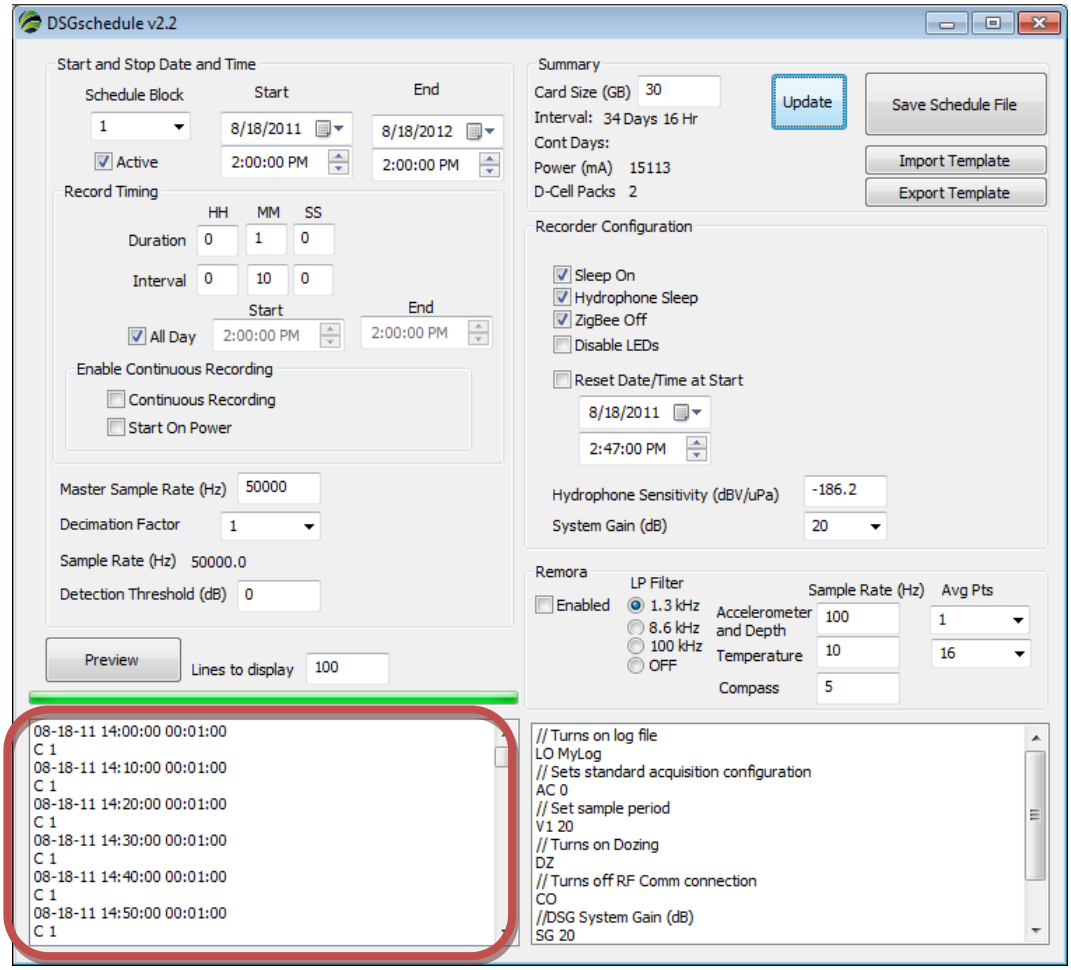
After configuring the Schedule Setup, click the Update button to determine file storage requirements.

Tip
The number of combinations of settings is infinite. It is highly recommended that a bench top test of the recording settings be made prior to deployment.

File Preview

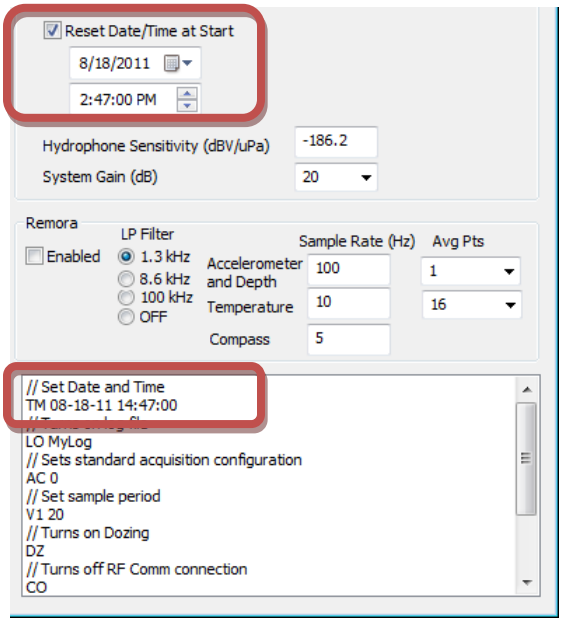
Click on the Preview Button to inspect what will be generated in the schedule file. The left panel shows what will be in *sched.txt*, and the right panel shows what will be in *default.txt*.

Inspect the timing to make sure that it will produce the schedule you desire.



Setting the Date and Time

DSG has an internal real-time clock that is powered by a Lithium coin cell (CR2032) so that it maintains the proper time, even when the main power is turned off. The date and time on DSG are set using the Default.txt file on the SD card with the TM command.



1. Program the SD card.
    a. In DSGschedule check Reset Date/Time at Start.
    b. Select the date and time that you will start the DSG. Remember to give yourself time to eject the SD card from the computer and insert it into the DSG.
    c. Eject the SD card (you may have to close DSGschedule to safely eject).
2. Insert SD card into DSG SD card slot.
3. Switch on DSG when it is the time you had entered in DSGschedule.
4. Wait for the green lights to flash and then go out. The current date/time are now programmed on the DSG board.
5. Disconnect power and remove SD card.
6. Insert DSG card into computer and reprogram ***without*** resetting the Date/Time. Note that it is possible to reset the date and time and just let the DSG run. The downside of this is that if the DSG accidentally restarts (e.g. if the batteries become disconnected and then reconnected), the time would be reset to the time indicated in the *Default.txt* file on the card, and not the current time.

After setting the date and time, the DSG will retain the current date and time. **Future schedule files should be created without resetting the date and time, unless it needs to be reset.**

Daylight Saving Time

There is no Daylight Saving Time on the DSG real-time clock.

Coin Cell

The coin cell will last for about five years. If the coin cell is dead, the DSG board will not maintain the programmed clock time when power is removed. DSG boards with soldered coin cells should be returned to Loggerhead Instruments for replacement.

Schedule Files

Schedule files are text files in the Script directory on the SD card that specify the start date and time and record duration. Every other line contains a code indicating whether the recording is continuous (C) followed by the decimation factor.

Record Start Date & Time		Duration
MM-DD-YY	HH:MM:SS	HH:MM:SS

Example Sched.txt file

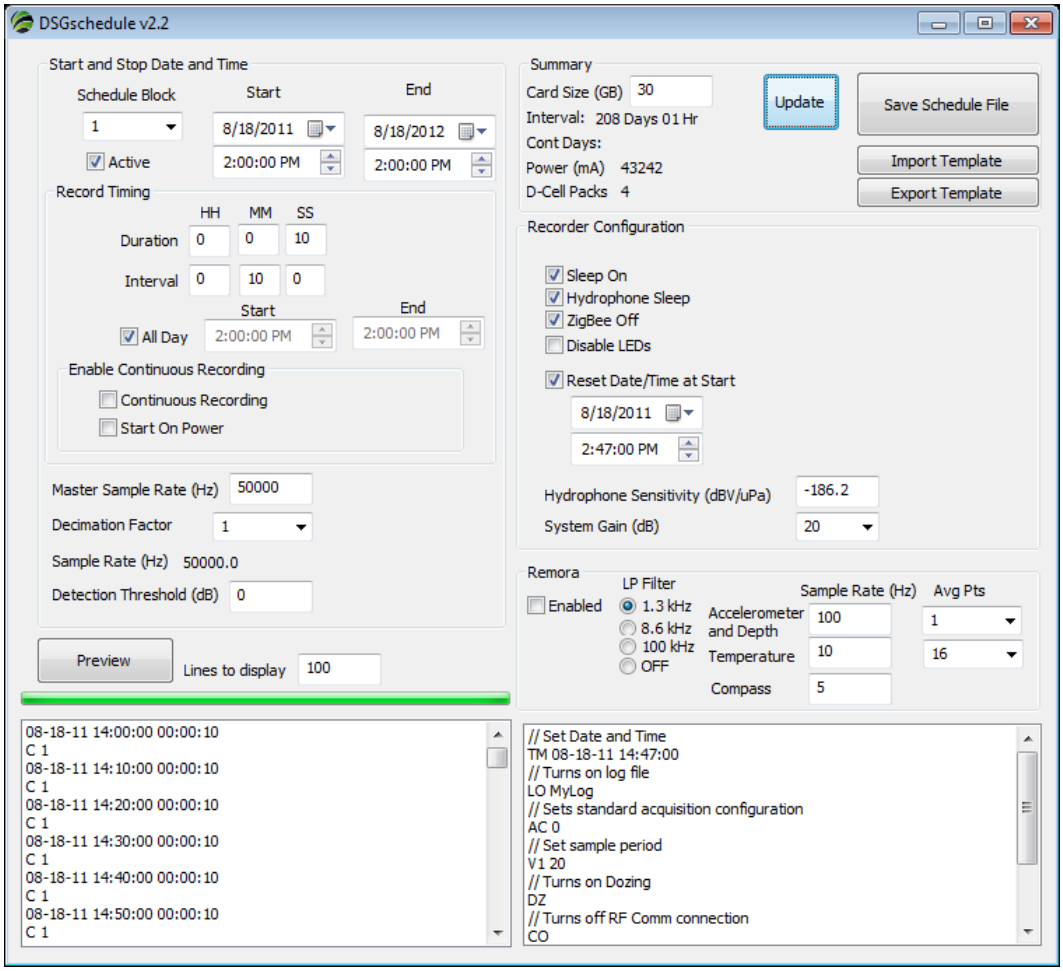
In this example a 6 second recording is made every minute, with a decimation factor of 1 (i.e. no decimation).

```
08-16-11 09:00:00 00:00:06

C 1

08-16-11 09:01:00 00:00:06

C 1

08-16-11 09:02:00 00:00:06

C 1

08-16-11 09:03:00 00:00:06

C 1
```

Example Schedule Files

The following presents several scenarios for constructing schedule files. It is important to examine the schedule files prior to deployment to make sure they do what you want. Schedule files can also be created manually if recording schedules are required which can not be produced with DSGschedule.

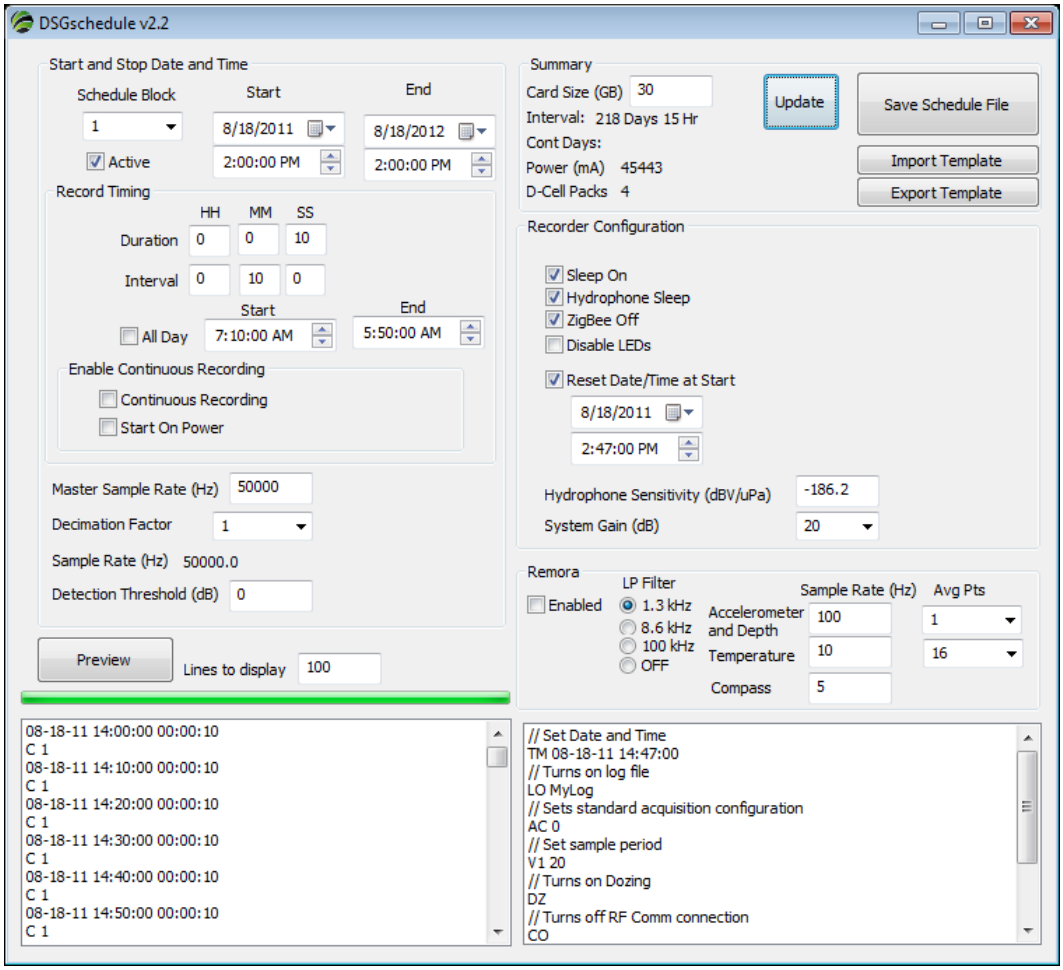
Scenario 1: Record 10 seconds every 10 minutes at 50,000 Hz sample rate. This can be created with 1 Schedule Block.



Note that the End date is beyond when the SD card will fill. By default DSGschedule sets the End date to be 1 year after the current date. In this case the DSG will run until its card is filled.

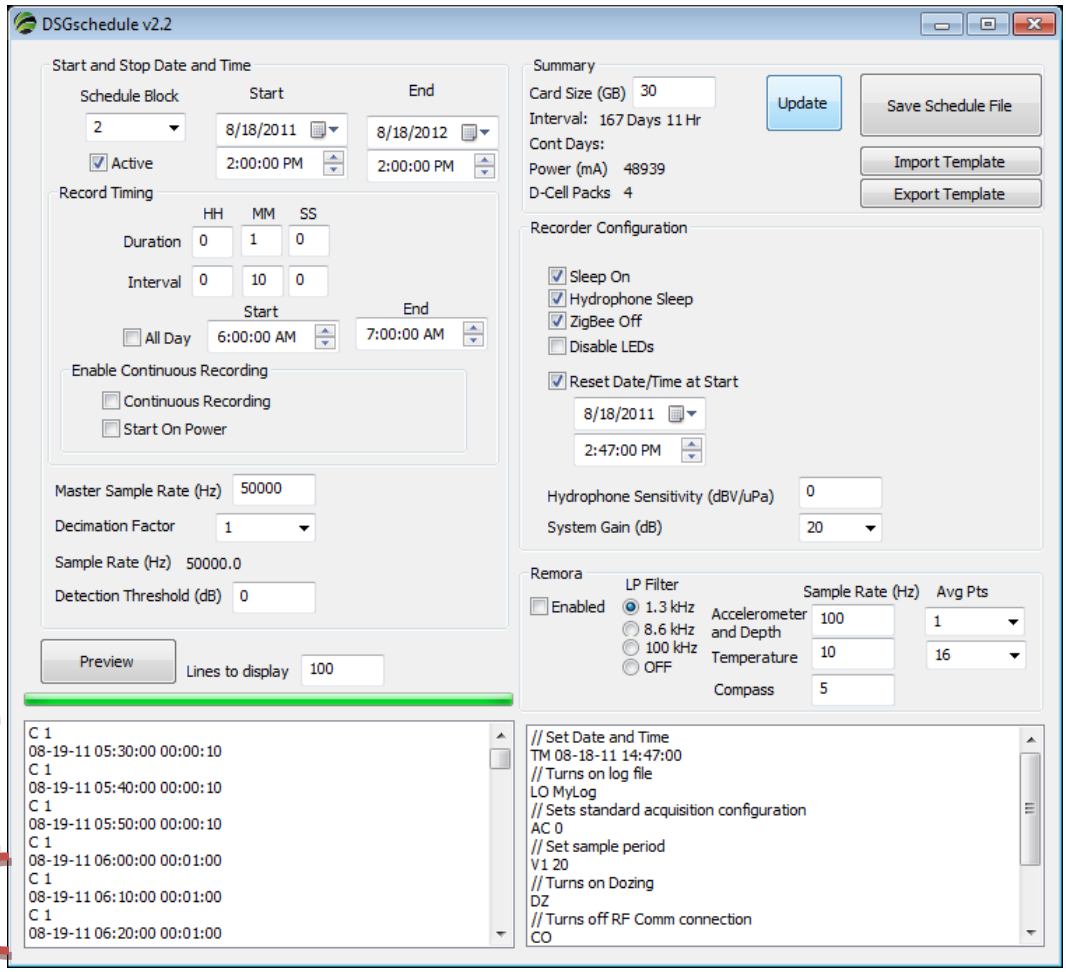
Scenario 2: This scenario will record more intensively at dawn than during the rest of the day. Record 10 seconds every 10 minutes at 50,000 Hz sample rate all day, and record for 1 minute every 5 minutes from 06:00 AM to 07:00 AM. This can be created with 2 Schedule Blocks. The Master Sample Rate specified for Block 1 will be used for all blocks.

Schedule Block 1
Uncheck All Day
Start: 7:10:00 AM
End: 5:50:00 AM



Schedule Block 2
Check Active
Uncheck All Day
Start: 6:00:00 AM
End: 7:00:00 AM

Click Update



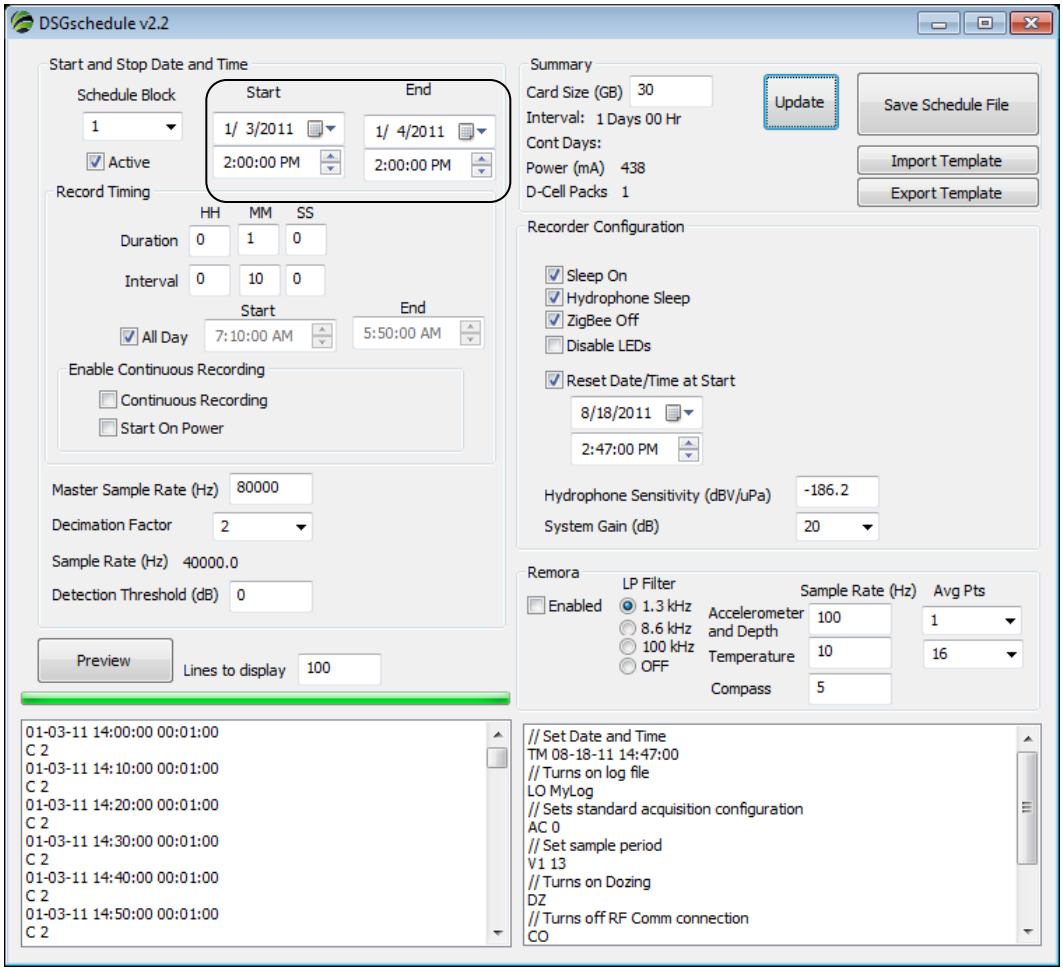
Block 1

Block 2

Tip—Overlapping Schedule Blocks
If Schedule Blocks overlap the DSG will follow the settings for the first line, and ignore the following record times which are overlapped.

Scenario 3: **Continuous Recording**. This scenario will use an interval recording for 1 day and then switch to continuous recording. The decimation factor will be used to record the interval recording at a final sample rate of 40 kHz and the continuous recording at 20 kHz.

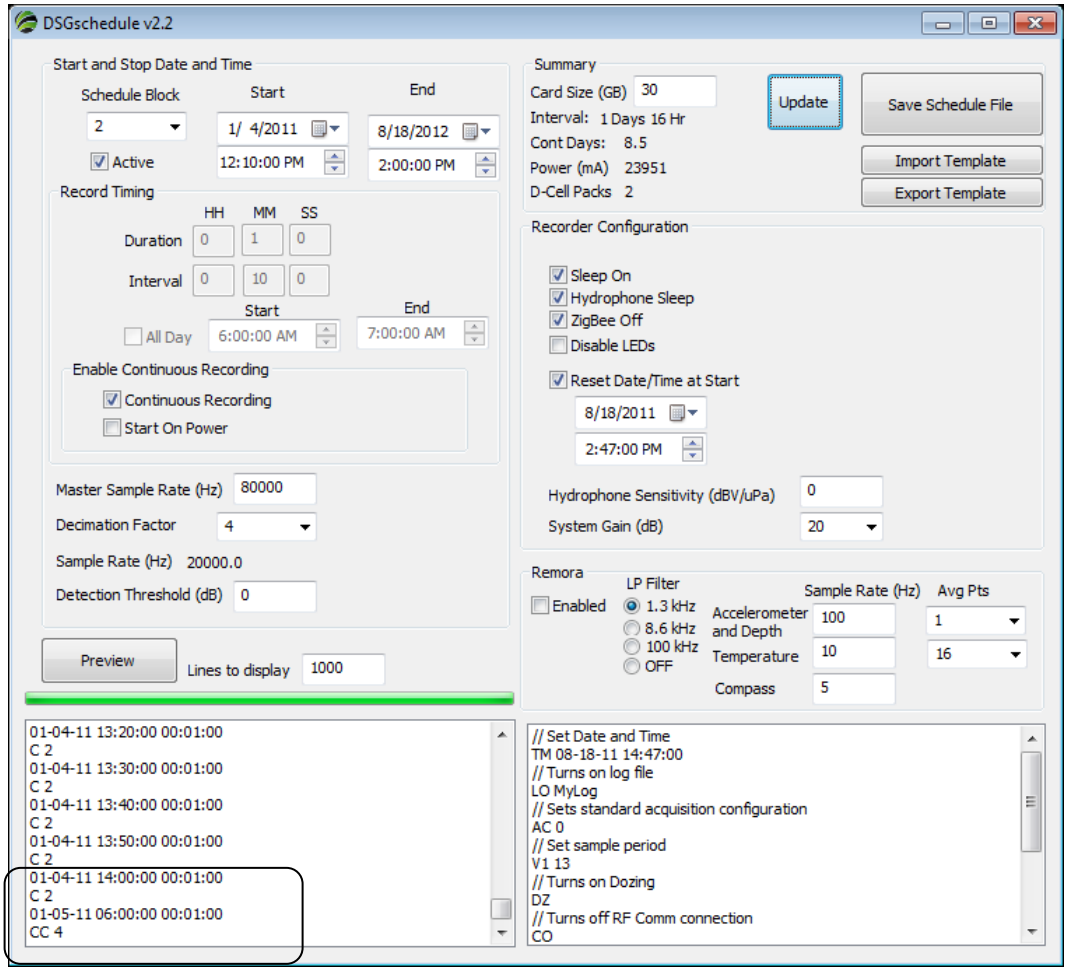
Block 1: Record 1 minute every 10 minutes all day from 3 Jan 2011 through 4 Jan 2011. The Master Sample Rate is set to 80,000 Hz, with a decimation factor of 2. Thus, the final sample rate of the interval recording is 40 kHz.



Block 2: Continuous recording starting on 4 Jan 2011 at 12:10:00 PM.
Select Block 2
Check Active
Check Continuous Recording
Change Decimation Factor to 4. Final Sample Rate will change to 20000.

Note that the start time for continuous recording does not coincide with a time from the first block. This is very important. If the continuous recording was started on 4 Jan 2011 at 12:00:00 PM, it would never be run, because there was an entry at that time from Block 1. Note that CC is the code for a continuous recording.

The Summary data indicates that you will have interval recording for 1 day 16 hours and continuous recording for 8.5 days.



Tip—Initial record
If you are starting the DSG with a long delay, it is useful to create a line in the schedule file that makes a short recording at the start of the session to verify that the DSG is working. This can be done with a separate Schedule Block. When DSG goes into sleep mode, no LEDs are illuminated.

LED Indicators

There are two LEDs, one on the edge (LED1) and on towards the middle of the board (LED2).

Normal Operation

Startup: When power is applied LED2 will turn Green for 2-60 seconds as the code is loaded and the memory card verified. If the card has just been programmed this time will be relatively short. If the DSG was started, stopped, and then restarted without reprogramming the card, this light may stay on for up to one minute as a checkdisk is performed.

Record Mode: LED1 will blink during wakeup and then go solid green when recording starts. LED2 will flash green during recording ad data is written to disk. If LED1 goes red, the DSG is not able to transfer data to the SD card fast enough for the recording configuration. This will happen at sample rates higher than 80 kHz, or with some decimation settings. It is best to do a test to verify data are not being dropped.

Sleep Mode On: In Sleep mode, no LEDs are on.

Sleep Mode Off: LED1 will blink green in between recording intervals.

Error Modes

LED2--blinking red at start; Clock is not set properly (time detected on clock is before year 2008).

LED1 and LED2—simultaneously blinking red at start; no SD card detected

LED1 and LED2-- alternately blinking red; schedule record has finished (can occur if there is no Script on the card, or if the card is not compatible with the DSG).

LED1: Solid red at start means unable to write to real-time clock. Remove power and try again.

Data

Data are saved as 16-bit .dsg files onto the Secure Digital card. The .dsg file format is described in the appendix. It consists of data blocks containing time stamps and blocks of 16-bit data. These files can be converted to wav files using the DSG2wav utility.

File Names
File names are created automatically and incremented starting at 1 and end with the file extension .dsg.

Stopping DSG
Wait to turn off power to DSG until recording of a file has ended to avoid corrupting a data file. After power is off, remove the SD card by pulling it out. Newer versions of the DSG board have the spring eject disabled to prevent accidental ejection.

Downloading Files
Files can be downloaded to a PC through an SDHC interface or the supplied USB SDHC drive. Note that SDHC cards may not be able to be read by older SD card readers that do not support SDHC cards.

Log Files

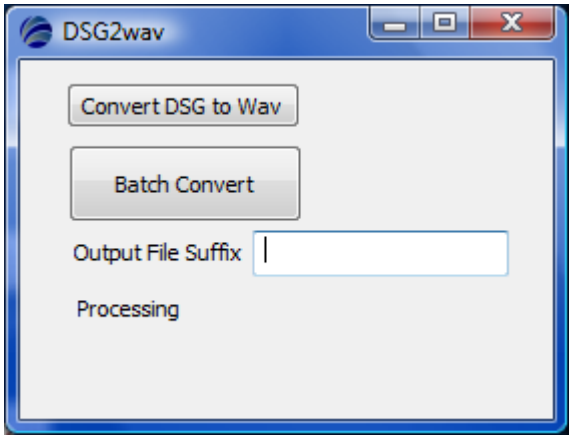
A log file (*MyLog*.txt) is created on the SD card in the Log directory that is used to store information on when the DSG was started and when each recording was made.

Example MyLog.txt

```
System     | 05-07-08 09:01:06 | Log Opened ******************
System     | 05-07-08 09:01:06 | Session Started
System     | 05-07-08 09:10:00 | Record Begin
Test       | 05-07-08 09:12:31 | Data 1842  3316
System     | 05-07-08 09:12:31 | Record End
System     | 05-07-08 09:20:00 | Record Begin
Test       | 05-07-08 09:22:31 | Data 1845  3212
System     | 05-07-08 09:22:31 | Record End
```

DSG2wav

DSG2wav will convert *.dsg* to *.wav* files. This process removes the dsg header and timing information from the files to create the .wav files.



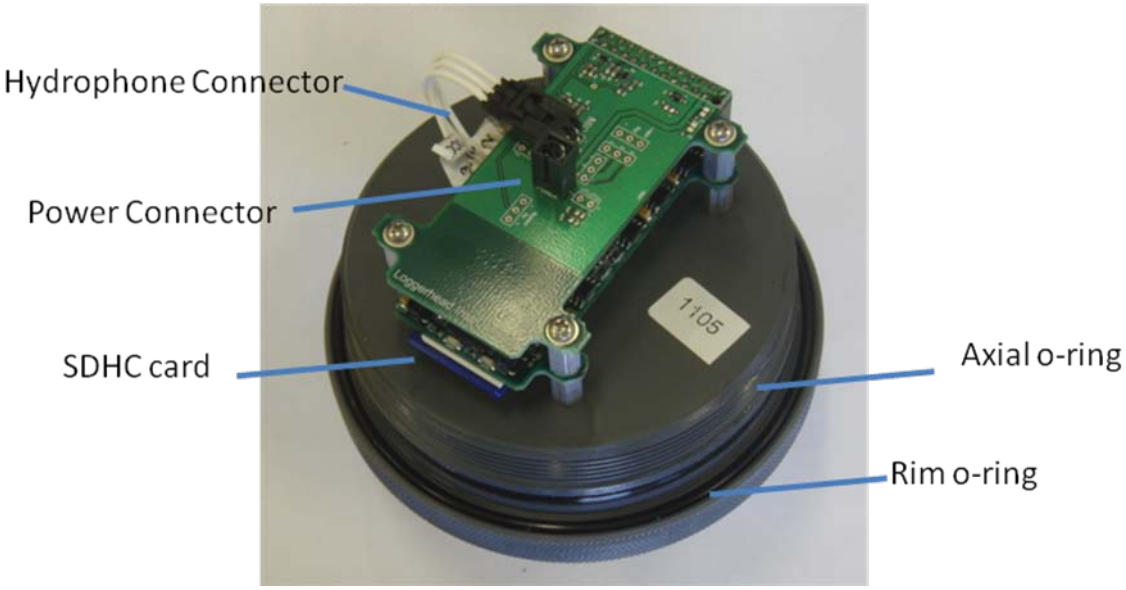
Convert DSG to Wav: Converts one file at a time allowing user to save the wav file to any destination.

Batch Convert: Converts entire folder of *.dsg* files to *.wav* files. The new files will be placed inside a subdirectory named *wav*. File names are derived from the *.dsg* file names with an optional suffix attached.

Output File Suffix: Optional text that will be added to the *.wav* file names.

Setting up DSG in Underwater Housing

Step 1. Prepare SDHC card. Program SDHC card with DSGschedule. Be sure to safely eject card before removing from computer. Insert SDHC card into DSG. The SDHC card is removed by pressing in on it to spring it out.



Step 2. **O-rings**. Clean and grease o-rings with silicone grease, and insert into the groove on the lid. There are two o-rings in each lid. The o-ring (size-155) on the rim is larger than the axial o-ring (size-153 prior to 2011; size-240 from 2011 on).

> **The o-rings need to be removed and cleaned for each use. If there are nicks in an o-ring do not use it. If you need more o-rings, contact Loggerhead Instruments.**

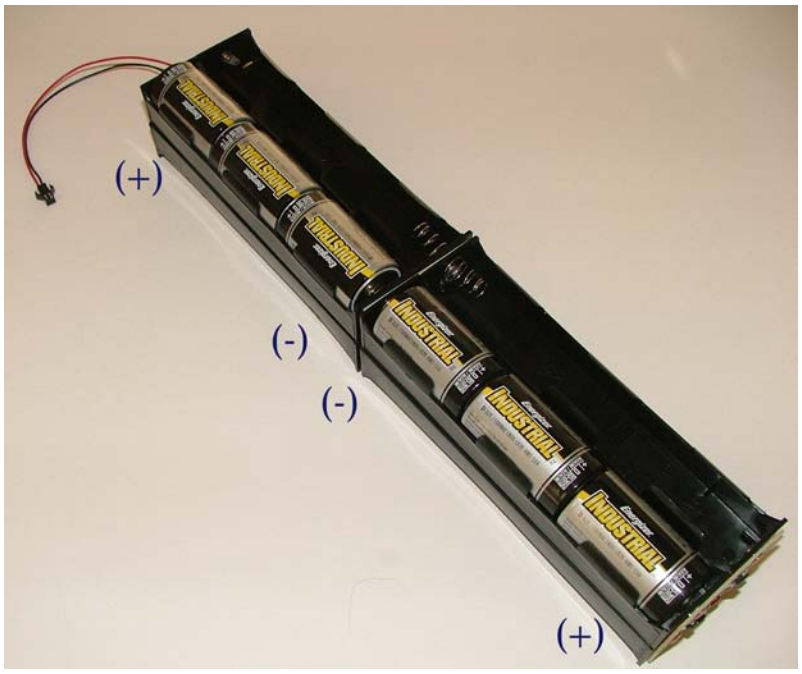
Step 3. Install batteries.

IMPORTANT: In double battery pack, the batteries are oriented in opposite directions. The negative (-) flat side of the battery is positioned against the spring.

Batteries should be taped into holder to prevent them from falling out.

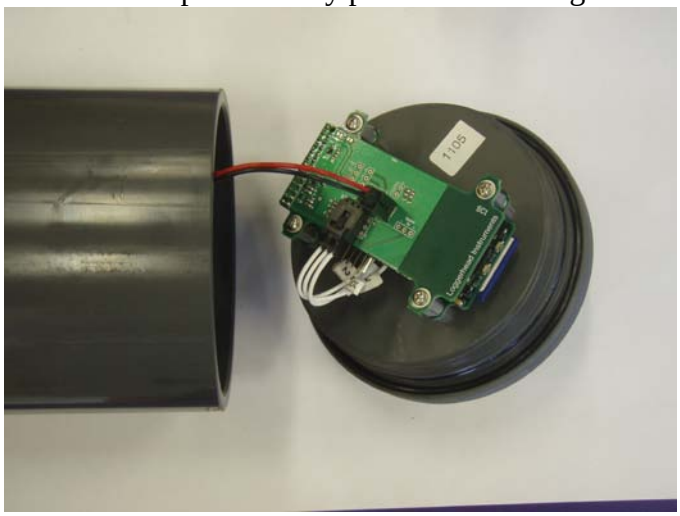
Either D-cells or rechargeable batteries may be used.
Note that battery life estimates in DSGschedule are for alkaline D-Cells.
Rechargeable batteries typically have less power.

Slide battery pack into housing as it lies on its side.



Note that the negative (flat) side of the batteries should be oriented towards the spring in the battery holder. This picture shows two of the eight 3-cell battery packs full. Note each battery pack is connected in parallel, so only one battery pack is required to power the DSG. DSGschedule will indicate the estimated number of alkaline battery packs required for a deployment based on the recording settings.

Step 4. Connect DSG battery connector to battery pack.
Connect to power connector on the DSG.
Verify that recording is occurring as desired through monitoring of the LEDs.
Slide power cable from battery pack through slit in foam.
Slide battery pack into housing and push foam down on top of battery pack. The foam will keep the battery pack from moving in the housing and producing noise.



Step 5. Close Housing
Place lid on housing.
Rotate **COUNTER-CLOCKWISE (LEFT) 3 FULL TURNS** so the power cord is not coiled when the lid is closed.
Rotate lid clockwise to seal. Hand tighten until the lid is fully seated. Be careful when screwing lid not to cross-thread the lid and housing threads.

Step 6. Attach hydrophone. Attach hydrophone to the top of the housing. The hydrophone has one silver guide pin to insure proper alignment. Align hydrophone and then press straight down to insert it. Once hydrophone is seated, hand-turn retaining collar on hydrophone onto the bulkhead connector.

DSG Deployment and Maintenance

Deployment Attachments
The DSG has two bands milled on the side which can be used as attachment points for hose clamps. If you are attaching the DSG to a subsurface line you may wish to put a third hose clamp close to the top to prevent the line from banging against the housing and hydrophone. There is no band here because the housing is thinner at the top.

Use 316 Stainless Steel hose clamps.
Be sure not to overtighten hose clamps on housing.

Buoyancy and Batteries
The DSG housing is about 6.3 pounds positively buoyant with no batteries. 3 D-cells weigh approximately 1 pound.

Lid Removal
Be sure to fully dry the housing before removing the lid. A strap wrench may be used to initially begin to unscrew the lid. The DSG has been coated with an acrylic conformal coating. If it is splashed with water, dry immediately. If it is immersed in water, remove it as soon as possible and immerse in alcohol.

Cold-water Deployment
If you are deploying the DSG in deep, cold water, you should place dessicant packets in the housing to prevent condensation on the electronics.

Batteries do not last as long in very cold water. Thus, you should use 50% more battery packs than suggested by DSGschedule.

SC1 Signal Conditioning Daughterboard

The SC1 signal conditioning daughterboard provides a high-pass input filter and switchable gain.

Gain

The gain setting is controlled by the DSG board. Typically the default gain of 20 dB is the recommended setting. Lower gain settings would be used if signal clipping was a problem.

HTI Hydrophone Specifications

If you purchased a complete DSG System, you will have received a hydrophone manufactured by High-Tech Inc. Included with this will be a copy of the calibration of the hydrophone (located at the back of this manual).

The hydrophone output has a 22 uF capacitor in series to filter DC.

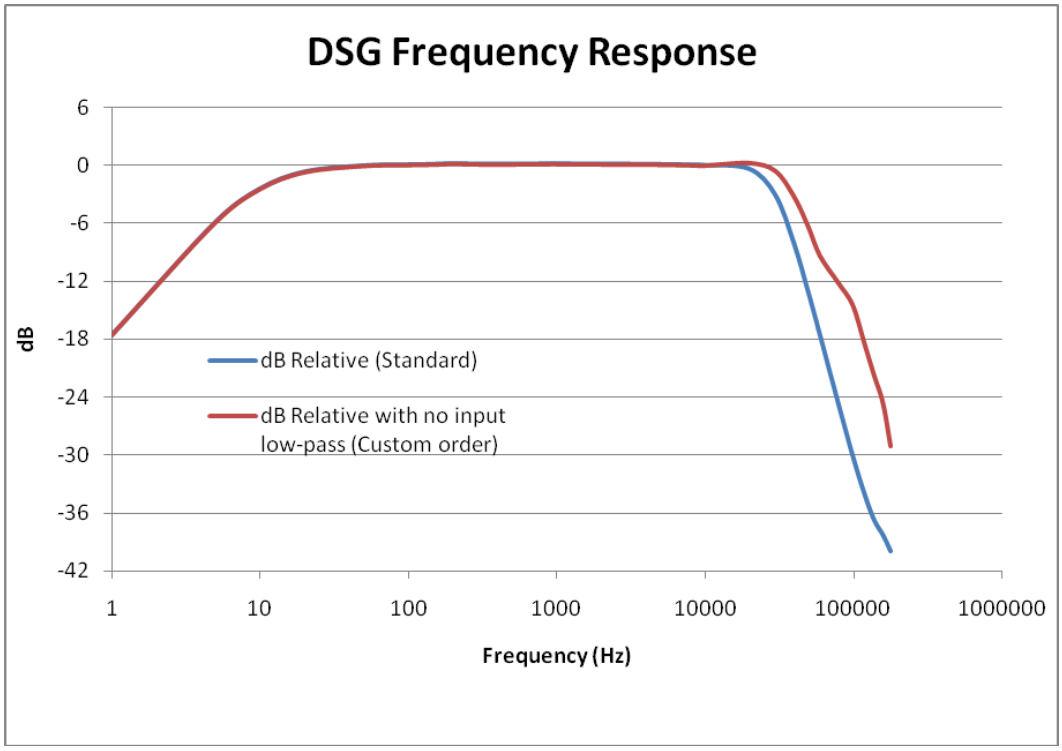
DSG Specifications

Maximum Input Voltage: ±0.1 V
A/D Resolution: 16-bit
Maximum Sample Rate: 80,000 Hz continuous
400,000 Hz in 1 s blocks

Low-Pass Filter: The standard DSG has a 35 kHz 3-pole low-pass filter on the hydrophone input.

Data Storage: SD or SDHC flash cards.
Power: 3.3-30.0 V
~100 mA running
~2 mA sleeping

Calibration: 10x gain on input (thus a 0.1 V signal is scaled to 32,767). Note this is the DSG board only. It does not include the SC1 gain board. See below for DSG+SC1.



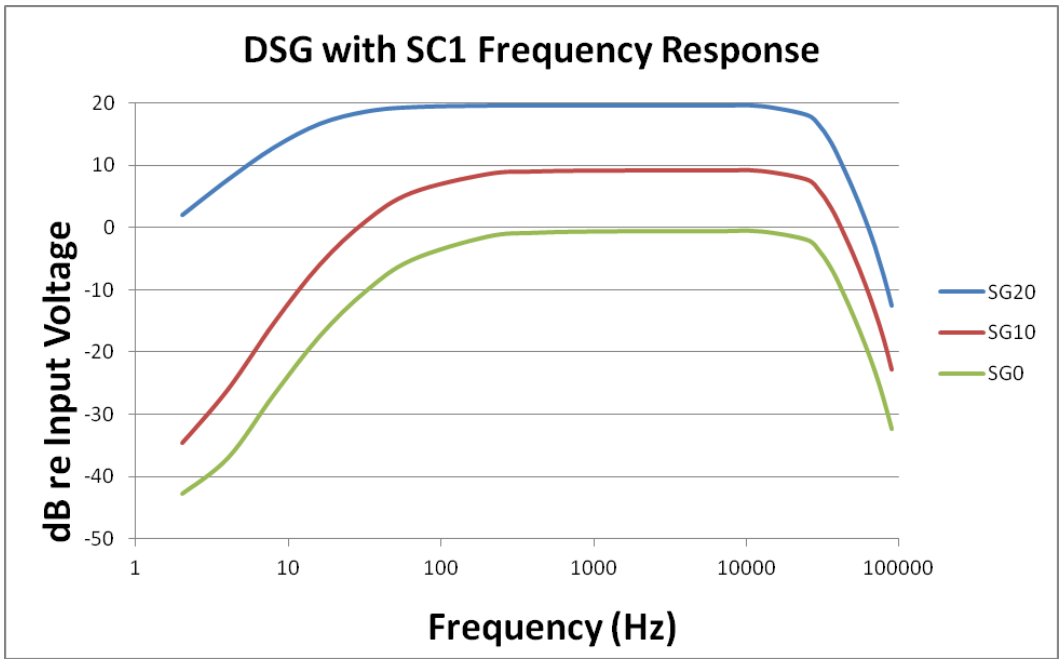
DSG Board Only

Freq (Hz)	dB Relative (Standard)	dB Relative with no input low-pass (Custom order)
1	-17.6	-17.6
5	-5.9	-5.9
10	-2.4	-2.4
20	-0.7	-0.7
50	0.0	0.0
100	0.1	0.1
150	0.1	0.1
200	0.2	0.2
300	0.1	0.1
400	0.1	0.1
500	0.1	0.1
1000	0.2	0.2
2000	0.1	0.1
4000	0.1	0.1
8000	0.0	0.0
10000	0.0	0.0
20000	-0.4	0.3
30000	-3.1	-0.5
40000	-8.0	-3.2
50000	-13.1	-6.3
60000	-17.5	-9.3
80000	-24.7	-12.2
100000	-30.1	-14.5
120000	-34.0	-18.5
140000	-36.8	-21.9
160000	-38.3	-24.7
180000	-39.9	-29.1

DSG+SC1 Sensitivity

These values indicate the relative signal level if the DSG readings are scaled to +/-1 (i.e. by dividing integer values by 32768).

Note that the input high-pass corner frequency changes with the gain setting. The typical recommended setting is SG20. You would use SG10 or SG0 if you expected to record extremely high signal levels (e.g. pile driving).

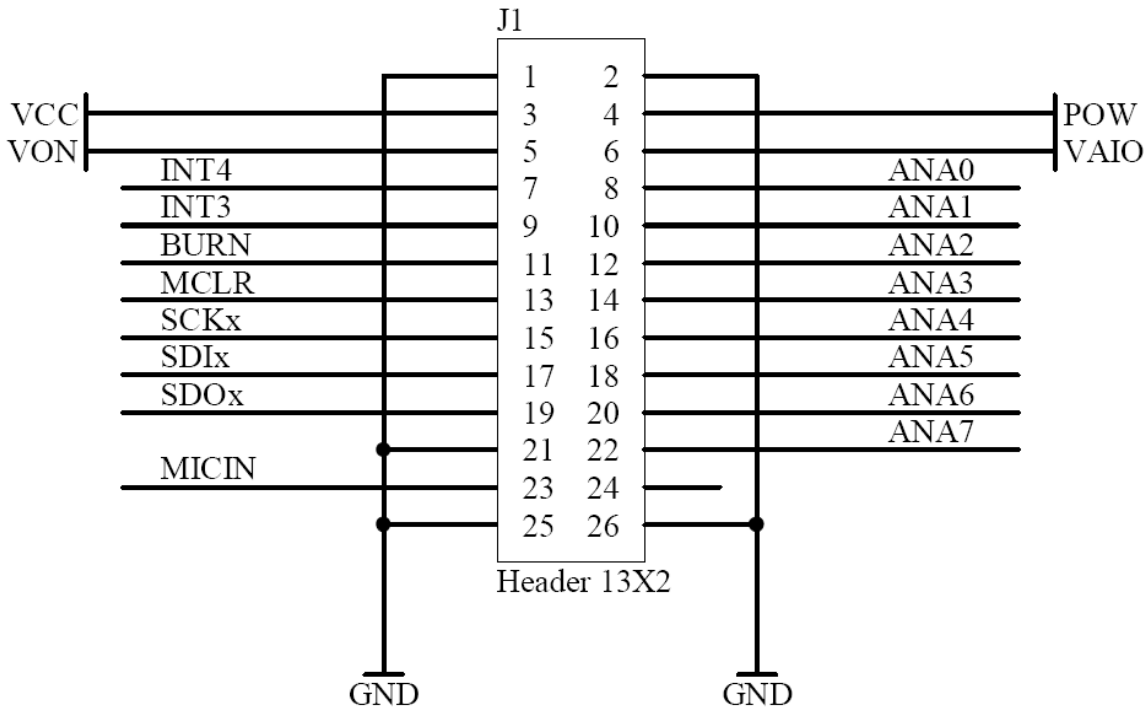


DSG+SC1 Sensitivity

Table showing sensitivity of DSG+SC1 board. Values are calculated by recording and input signal of known voltage and measuring the gain on the DSG after dividing the integer DSG samples by 32768.

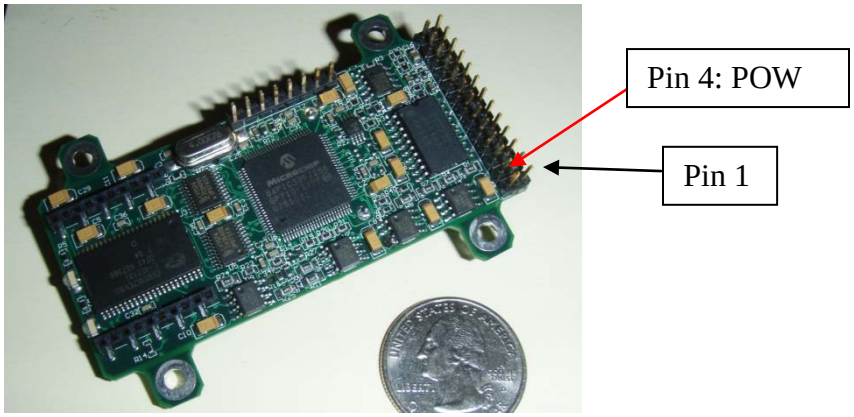
Frequency (Hz)	SG20	SG10	SG0
2	2.0	-34.6	-42.7
4	7.7	-25.9	-36.9
8	12.8	-15.3	-26.8
16	16.6	-5.9	-17.4
32	18.5	1.1	-10.2
64	19.3	5.6	-5.2
200	19.5	8.6	-1.5
400	19.5	9.0	-0.9
800	19.5	9.2	-0.7
1600	19.5	9.2	-0.6
3200	19.5	9.2	-0.6
6400	19.5	9.2	-0.6
12500	19.4	9.1	-0.7
25000	18.0	7.7	-2.0
30000	16.4	6.0	-3.7
35000	14.1	3.7	-6.1
40000	11.4	1.1	-8.7
50000	6.2	-4.2	-14.0
60000	1.4	-9.0	-18.7
70000	-3.2	-13.5	-23.2
80000	-7.9	-18.0	-27.7
90000	-12.5	-22.8	-32.3

DSG Board Pinouts



Orientation: Pin 1 has a square solder pad on the DSG board.

POW: Input power. 3.7 V – 30 V. Voltage regulator is National LP2951.
VAIO: 3.3 V regulated output. Turned off when sleeping.
VON: 3.3 V regulated output. Always on.
MICIN: Signal Input. ±0.1V input for microphone, hydrophone, or other signal.
ANA0-ANA7: Analog inputs on dsPIC33F. Not currently implemented in current firmware release.



PICkit2 Microcontroller Programmer

Your DSG ships with a PICkit2 microcontroller programmer. The PICkit2 is used to update the firmware on the DSG's microcontroller as new releases are made. When you receive your DSG its flash memory is already programmed with the latest version of the firmware, so you do not need to do anything with the PICkit2. Loggerhead Instruments will notify you as new firmware releases become available.

DSG Software Revision History

DSG Software (firmware loaded on board)

DSG v1.0	May 2008 Initial Release
DSG v1.1	Added support for stutter recording
DSG v1.6	Added support for continuous recording, ZIGBEE wireless. Error trapped situations where wake up time is prior to current time. Synchronized version number with DSGschedule.
DSG v1.7	Added support for Remora
DSG v2.0	Removed stutter. Added support for system gain and hydrophone calibration. Continuous Recording: Added just start feature (will start as soon as power applied). Added Decimation of Master Sample Rate Added detection threshold.

DSGschedule

March 15, 2009. v1.11: Corrected rounding to realizable sample rates. Also checks sample rate when Update is clicked.
August 9, 2009. V1.12: Fixed bug in creating schedule files with multiple groups where groups did not overlap in time.
August 30, 2009. V1.6: Added support for continuous recording. Corrected calculations for days to fill and power. Added file preview. Continuous recording required upgrading of DSG firmware to v1.6.
August 18, 2011. v2.2: Removed stutter. Added support for system gain and hydrophone calibration. Continuous Recording: Added just start feature (will start as soon as power applied). Added Decimation of Master Sample Rate. Added detection threshold.

DSG2wav

March 15, 2009. v1.1: Fixed rounding error in calculating sample rate. Was a problem for high sample rates (e.g. 266 kHz). Had been calculated correctly for lower sample rates (e.g. 50 kHz). The sample period stored within the .dsg file was always correct.

DSG File Format

```
#define DF_VERSION                          2000

typedef struct
{
       ULONG Version;
       ULONG UserID;
       TIME_HEAD RecStartTime;
       float Lat;
       float Lon;
       float depth;
       float DSGcal;
       float hydroCal;
       float lpFilt;
}DF_HEAD;


// DM added RECPTS and RECINT
typedef struct
{
       ULONG   SID;
       ULONG   nBytes;        // Size in bytes of this record (excluding header)
       ULONG   NumChan;       // Number of expected channels in store
       ULONG   StoreType;
       ULONG   CircType;
       ULONG   DForm;
       ULONG   SP256;         // Sample period (us) x 256
       ULONG   RECPTS;        // rec points =0 for continuous
       ULONG   RECINT;        // interval between rec pts;
}SID_SPEC;

typedef struct
{
       BYTE    nSID;          // This is record I/D
       BYTE    Chan;          // Channel index
       DLONG   TS256;         // Sample number since started recording in file
}SID_REC;
```