

APPENDIX _DATA	
Name	Short description
Data Delivery Policy	Requirements on data delivery for PASSCAL
SEED FORMAT	Brief description of seed format for archiving of passive source data
Batch file	Details on how to generate a batch file in antelope
REVIEW Q330 SOH and WAVEFORM CHANNELS	Detail on Q330 State of health channels and traces
RT130 Log and Logpeek	RT130 log file and how to see it with logpeek
Troubleshooting	Common problems when processing data for archiving

PASSCAL Data Delivery Policy

November 18, 2004

The equipment in the PASSCAL facility represents a significant community resource. The quality of the data collected by this resource is such that it will be of interest to investigators for many years. In order to encourage the use of the data by others and thereby make the facility of more value to the community, IRIS policy states that all data collected by instruments from the PASSCAL Facility should be submitted to the Data Management Center, so that other interested investigators can access them after the proprietary period.

This policy outlines the guidelines for data submission. IRIS policy is that delivery of data to the DMC is an obligation of the PI. It is important to IRIS that the PI acknowledges this obligation and meets it within the required time frame. Failure to complete this requirement not only deprives the community of a valuable resource, but also may jeopardize future requests to borrow IRIS equipment.

IRIS expects data delivery while the experiment is in the field (for long term deployments), or immediately at the conclusion of the field deployment. The data and Data Report will remain confidential for a period of 2 years after the end of the fieldwork.

Data Report

The Data Report is not intended as a formal technical paper, but it should contain enough information to allow someone to work with the data. If possible the report should be in a widely accepted electronic format such as RTF or PDF. Any figures can be included as Postscript files. The following types of information should be included:

- * A short description of the experiment;
- * A list of stations occupied along with coordinates and a short description of the sites;
- * A description of the type of calibration information acquired; and
- * For non-SEED data a description of the data archive volume.

The Data Report and completed Demobilization Form are due immediately after the completion of the experiment.

Data

The actual format and amount of data depend upon the type of experiment. Most PASSCAL experiments fall into one of the following categories: Broadband, short period or reflection/refraction. The first two are passive source experiments while the third utilizes active sources.

Broadband (continuous data)

The data from broadband experiments (that is experiments collecting continuous data from broadband sensors at sample rates less than or equal to 40 sps) can be used in a variety of

different investigations. Therefore, it is in the best interest of the community to archive these data for easy access by the seismology community. Each PI conducting a broadband experiment will utilize the PASSCAL database or equivalent software to send all of the data collected to the DMC for archive in SEED format. It is expected that the PI will ship the data to the DMC on a continuing basis during the experiment as soon as timing and other corrections are made, and that the final data will arrive shortly after the experiment is over. The DMC will make the data available only to the PI or his designated representative for a period of two years after the completion of the experiment. After that, the data will be made available to the public.

Short Period (triggered)

Short period experiments are generally different from broadband experiments in both the amount and the bandwidth of the data they produce. Short period sensors are generally run at higher sample rates than broadband sensors, and the ability to record low frequency signals is very limited. As the short period data are typically recorded in a triggered mode, their principal archive will be as event data. The time windows should be long enough to include a reasonable amount of pre-event noise signal as well as all of the significant seismic phases for the event. As above, the data should be delivered to the DMC for distribution in SEED format. The PASSCAL field computers have the necessary software for this delivery.

Reflection/Refraction

Reflection/Refraction experiments differ from the above experiments in that they nearly always involve active sources. The receivers are typically arranged in regular one or two-dimensional arrays. The accepted data format for these active source experiments is conventional SEG-Y format. The data should include all of the necessary information on the geometry of the experiment (metadata) and they should be corrected for all known timing problems.

Non-Standard

There will always be some experiments that do not fit directly into one of the above categories. In those cases the exact form of the data delivery will be negotiated between the PI, the IRIS Data Management System and PASSCAL.

Proprietary Data

Data of all types should be delivered to the DMC, in the appropriate format, as soon as possible and normally well before the general release of the data. The DMC will only allow access to the waveforms to the PI and others designated by the PI. Access will be by password that will be provided by the DMC to the PI. The PI can share the password with anyone he/she wishes. The PI will be notified when anyone registers for access to a proprietary dataset.

Information about the experiment such as station locations and characteristics will be made publicly available during the experiment, only waveform data will be limited in distribution during the proprietary period.

All passive experiments with five or more stations will designate at least one station as an "open station". The data from the open station(s) will be made available to the public immediately upon being archived.

Support Available from IRIS

Every field computer has the software necessary to accomplish the data delivery task, and the PASSCAL Instrument Center has personnel who can provide assistance to the PI during and after the experiment. The Instrument Center also has software, computers, and large disk systems available for use by the PI. The Data Management System has additional facilities and support available to the PI. The PI is encouraged to use these resources at all stages of the work. In all cases, however, the ultimate responsibility for delivery of the data rests with the Principal Investigator. The PI must ensure that adequate resources are budgeted to accomplish this task.

A PASSCAL data submission is not considered complete until both the PASSCAL and DMS Program Managers certify that the information contained in the report is sufficient to allow other members of the community to utilize the data. IRIS will not certify that it has received data from any PI until the data submission is deemed useable.

This policy is effective as of November 18, 2004 and is subject to change and revision as needs dictate. For updated versions of the policy and additional information on data delivery see the PASSCAL and DMS pages on the IRIS web site (<http://www.iris.edu>).

SEED Format definitions

1. MSED HEADERS

MiniSEED (MSED, mseed) format is strictly defined by the Standard for the Exchange of Earthquake Data (SEED) Reference Manual, SEED format version 2.4, Appendix A. (<http://www.iris.edu/manuals/SEEDManual V2.4.pdf>) , the following document is a copy of the Appendix A in the seed format manual.

Appendix A: Channel Naming

Contributed by Scott Halbert

Seismologists have used many conventions for naming channels. Usually, these conventions are designed to meet the particular needs of one network. But general recording systems — such as the various Global Seismographic Network (GSN) systems that can record many channels at high sample rates — create a need for a standard to handle the variety of instruments that can be recorded. Modern instrumentation and the need for conformity among cooperating networks have greatly complicated the problem. Sensors are available in narrow band and broadband configurations with pass bands in very different parts of the spectrum of interest. Each sensor may have several different outputs with different spectral shaping. In addition, station processors often derive several data streams from one sensor channel by digital filtering. These possibilities require a comprehensive convention. The desire to combine data from cooperating networks and to search for like channels automatically requires standardization.

The SEED format uses three letters to name seismic channels, and three letters to name weather

or environmental channels. In the following convention, each letter describes one aspect of the instrumentation and its digitization. SEED does not require this convention, but we recommend it as a usage standard for Federation members to facilitate data exchange.

Band Code

The first letter specifies the general sampling rate and the response band of the instrument. (The "A" code is reserved for administrative functions such as miscellaneous state of health.)

Band code	Band type	Sample rate (Hz)	Corner period (sec)
F	...	≥ 1000 to < 5000	≥ 10 sec
G	...	≥ 1000 to < 5000	< 10 sec
D	...	≥ 250 to < 1000	< 10 sec
C	...	≥ 250 to < 1000	≥ 10 sec
E	Extremely Short Period	≥ 80	< 10 sec
S	Short Period	≥ 10 to < 80	< 10 sec
H	High Broad Band	≥ 80	≥ 10 sec
B	Broad Band	≥ 10 to < 80	≥ 10 sec
M	Mid Period	> 1 to < 10	
L	Long Period	$= 1$	
V	Very Long Period	$= 0.1$	
U	Ultra Long Period	$= 0.01$	
R	Extremely Long Period	$= 0.001$	
P	On the order of 0.1 to 1 day*	≥ 0.00001 to < 0.0001	
T	On the order of 1 to 10 days*	≥ 0.000001 to < 0.00001	
Q	Greater than 10 days*	< 0.000001	
A	Administrative Instrument Channel	variable	NA
O	Opaque Instrument Channel	variable	NA

Instrument Code and Orientation Code

The second letter specifies the family to which the sensor belongs. The third letter specifies the physical configuration of the members of a multiple axis instrument package or other parameters as specified for each instrument.

Seismometer: Measures displacement/velocity/acceleration along a line defined by the dip and azimuth.

Instrument Code

H	High Gain Seismometer
L	Low Gain Seismometer
G	Gravimeter
M	Mass Position Seismometer
N*	Accelerometer

** Historically, some channels from accelerometers have used instrument codes of L and G. The use of N is the FDSN convention as defined in August, 2000.*

Orientation Code

Z N E	Traditional (Vertical, North-South, East-West)
A B C	Triaxial (Along the edges of a cube turned up on a corner)
T R	For formed beams (Transverse, Radial)
1 2 3	Orthogonal components but non traditional orientations
U V W	Optional components
Dip/Azimuth:	Ground motion vector (reverse dip/azimuth if signal polarity incorrect)
Signal Units	M, M/S, M/S**2, (for G & M) M/S**2 (usually)
Channel Flags	G

Tilt Meter: Measures tilt from the horizontal plane. Azimuth is typically N/S or E/W.

Instrument Code

A

Orientation Code

N E	Traditional
Dip/Azimuth	Ground motion vector (reverse dip/azimuth if signal polarity incorrect)
Signal Units	Radians
Channel Flags	G

Creep Meter: Measures the absolute movement between two sides of a fault by means of fixing a metal beam on one side of the fault and measuring its position on the other side. This is also done with light beams.

The orientation and therefore the dip and azimuth would be perpendicular to the measuring beam (light or metal), which would be along the average travel vector for the fault. Positive/Negative travel would be arbitrary, but would be noted in the dip/azimuth. Another type of Creep Meter involves using a wire that is stretched across the fault. Changes in wire length are triangulated to form movement vector.

Instrument Code

B

Orientation Code

Unknown

Dip/Azimuth: Along the fault or wire vector

Signal Units: M

Channel Flags: G

Calibration Input: Usually only used for seismometers or other magnetic coil instruments. This signal monitors the input signal to the coil to be used in response evaluation. Usually tied to a specific instrument. Sometimes all instruments are calibrated together, sometimes horizontals are done separately from verticals.

Instrument Code

C

Orientation Code

A B C D... for when there are only a few cal sources for many devices.

Blank if there is only one calibrator at a time or, Match Calibrated Channel (i.s. Z, N or E)

Pressure: A barometer, or microbarometer measures pressure. Used to measure the weather pressure or sometimes for state of health monitoring down hole. This includes infrasonic and hydrophone measurements.

Instrument Code

D

Orientation Code

O Outside

I	Inside
D	Down Hole
F	Infrasound
H	Hydrophone
U	Underground
Dip/Azimuth:	Not applicable Should be zero.
Signal Units:	Pa (Pascals)
Channel Flags:	W or H

Electronic Test Point: Used to monitor circuitry inside recording system, local power or seismometer. Usually for power supply voltages, or line voltages.

Instrument Code

E

Orientation code

Designate as desired, make mnemonic as possible, use numbers for test points, etc.

Dip/Azimuth: Not applicable

Signal Units: V, A, Hz, Etc.

Channel Flags: H

Magnetometer: Measures the magnetic field where the instrument is sitting. They measure the part of the field vector that is aligned with the measurement coil. Many magnetometers are three axis. The instrument will typically be oriented to local magnetic north. The dip and azimuth should describe this in terms of the geographic north.

Example: Local magnetic north is 13 degrees east of north in Albuquerque. So if the magnetometer is pointed to magnetic north, the azimuth would be + 103 for the E channel. Some magnetometers do not record any vector quantity associated with the signal, but record the total intensity. So, these would not have any dip/azimuth.

Instrument Code

F

Orientation Code

Z N E	Magnetic
Signal Units:	T Teslas
Channel Flags:	G

Humidity: Absolute/Relative measurements of the humidity. Temperature recordings may also be essential for meaningful results.

Instrument Code

I

Orientation Code

O	Outside Environment
I	Inside Building
D	Down Hole
1 2 3 4	Cabinet Sources

All other letters available for mnemonic source types.

Dip/Azimuth:	Not applicable Should be zero.
Signal Units:	%
Channel Flags:	W

Rotational Sensor: Measures solid-body rotations about an axis, commonly given in "displacement" (radians), velocity (radians/second) or acceleration (radians/second²).

Instrument Code

J

Orientation Code

Z N E	Traditional (Vertical, North-South, East-West)
A B C	Triaxial (Along the edges of a cube turned up on a corner)
T R	For formed beams (Transverse, Radial)
1 2 3	Orthogonal components but non traditional orientations
U V W	Optional components
Dip/Azimuth:	Axis about which rotation is measured following right-handed rule.

Signal Units: rad, rad/s, rad/s² – following right-handed rule
Channel Flags: G

Temperature: Measurement of the temperature at some location. Typically used for measuring:

1. Weather - Outside Temperature
2. State of Health - Inside recording building
- Down hole
- Inside electronics

Instrument Code

K

Orientation Code

O Outside Environment
I Inside Building
D Down Hole
1 2 3 4 Cabinet sources

All other letters available for mnemonic types.

Dip Azimuth: Not applicable Should be zero.
Signal Units: deg C or deg K
Channel Flags: W or H

Water Current: This measurement measures the velocity of water in a given direction. The measurement may be at depth, within a borehole, or a variety of other locations.

Instrument Code

O

Orientation Code

Unknown

Dip/Azimuth: Along current direction
Signal Units: M/S

Channel Flags: G

Geophone: Very short period seismometer, with natural frequency 5 - 10 Hz or higher.

Instrument Code

P

Orientation Code

Z N E Traditional

Dip/Azimuth: Ground Motion Vector (Reverse dip/azimuth if signal polarity incorrect)

Signal Units: M, M/S, M/S

Channel Flags: G

Electric Potential: Measures the Electric Potential between two points. This is normally done using a high impedance voltmeter connected to two electrodes driven into the ground. In the case of magnetotelluric work, this is one parameter that must be measured.

Instrument Code

Q

Orientation Code

Unknown

Signal Units: V Volts

Channel Flags: G

Rainfall: Measures total rainfall, or an amount per sampling interval.

Instrument Code

R

Orientation Code

Unknown

Dip/Azimuth: Not applicable Should be zero.

Signal Units: M, M/S

Channel Flags: W

Linear Strain: One typical application is to build a very sensitive displacement-measuring device, typically a long quartz rod. One end is affixed to a wall. On the free end, a pylon from the floor reaches up to the rod where something measures the position of the pylon on the rod (like a large LVDT).

There are also some interferometry projects that measure distance with lasers.

Dip/Azimuth are the line of the movement being measured. Positive values are obtained when stress/distance increases, negative, when they decrease.

Instrument Code

S

Orientation Code

Z N E Vertical, North-South, East-West

Dip/Azimuth: Along axis of instrument

Signal Units: M/M

Channel Flags: G

Tide: Not to be confused with lunar tidal filters or gravimeter output. Tide instruments measure the depth of the water at the monitoring site.

Instrument Code

T

Orientation Code

Z Always vertical

Dip/Azimuth: Always vertical

Signal Units: M Relative to sea level or local ocean depth

Channel Flags: G

Bolometer: Infrared instrument used to evaluate average cloud cover. Used in astronomy to determine observability of sky.

Instrument Code

U

Orientation Code

Unknown

Dip/Azimuth: Not applicable Should be zero.

Signal Units: Unknown

Channel Flags: W

Volumetric Strain: Unknown**Instrument Code**

V

Orientation Code

Unknown

Dip/Azimuth: Not Applicable Should be zero.

Signal Units: M^{**3}/M^{**3}

Channel Flags: G

Wind: Measures the wind vector or velocity. Normal notion of dip and azimuth does not apply.**Instrument Code**

W

Orientation Code

S Wind speed

D Wind Direction Vector Relative to geographic North

Dip/Azimuth: Not Applicable Should be zero.

Channel Flags: W

Synthesized Beams: This is used when forming beams from individual elements of an array. Refer to blockettes 35, 400, & 405.

Instrument Code

Z

Orientation Code

I Incoherent Beam

C Coherent Beam

F FK Beam

O Origin Beam

Dip/Azimuth: Ground motion vector (reverse dip/azimuth if signal polarity incorrect)

Signal Units: M, M/S, M/S**2, (for G & M) M/S**2 (usually)

Channel Flags: G

Channel Code

We suggest that two sequences be reserved for special channels: the “LOG” channel for the console log, and the “SOH” channel for the main state of health channel. Subsidiary logs and state of health channels should begin with the “A” code; the source and orientation fields can then be used in any way.

Here are some typical channel arrangements used by a GSN system:

Channel	Description
EHZ/EHN/EHE	Short Period 100 sps
BHZ/BHN/BHE	Broad Band 20 sps
LHZ/LHN/LHE	Long Period 1 sps
VHZ/VHN/VHE	Very Long Period 0.1 sps
BCI	Broad Band Calibration Signal
ECI	Short Period Cal
LOG	Console Log
ACE	Administrative Clock Error
LCQ	1hz Clock Quality
OCF	Opaque Configuration File

NOTE: Log Records: Log records have a channel identifier code of “LOG” and a sample rate of zero. The number of samples field is the number of characters in the record (including the carriage return and line feed that terminates each line). Log messages are packed into records

until a message falls into a new minute. Log records have no blockettes, so the strings start at offset 48. For examples of Log Records, ACE, and OCF channels, refer to the end of Appendix E.

End of appendix A from SEED Manual

Recommended SEED Channel Names

George Slad (Data Group at PASSCAL)

Instrument	Sample Rates (Hz)							
	>= 1000 to < 5000	>= 250 to < 1000	>= 80 to < 250	10 >= to < 80	>1 to < 10	1	0.1	0.01
STS-2	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
CMG-3T	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
CMG-ESP	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
TR-240	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
TR-120	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
TR-40	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
CMG-40T 30s	FH?	CH?	HH?	BH?	MH?	LH?	VH?	UH?
CMG-40T 1s	GH?	DH?	EH?	SH?	MH?	LH?	VH?	UH?
S-13	GH?	DH?	EH?	SH?	MH?	LH?	VH?	UH?
HS-10	GH?	DH?	EH?	SH?	MH?	LH?	VH?	UH?
L-4C*	GL?	DL?	EL?	SL?	ML?	LL?	VL?	UL?
L-22*	GL?	DL?	EL?	SL?	ML?	LL?	VL?	UL?
L-28	GL?	DL?	EL?	SL?	ML?	LL?	VL?	UL?
L-28LB (4.5 Hz geophone)*	GL?	DL?	EL?	SL?	ML?	LL?	VL?	UL?
L-40A (40 Hz geophone)*	GL?	DL?	EP?	SP?	MP?	LP?	VP?	UP?
FBA ES-T	FN?	CN?	HN?	BN?	MN?	LN?	VH?	UN?

- If the datalogger uses a non-unity gain (e.g. 32) the 2nd letter of the channel name may need to be set to “H” if the overall sensor*datalogger gain is 250 V/m/s or greater. Read the Notes section below for details.

•

Table 1. Recommended SEED channel names for many of the sensors available from PASSCAL.

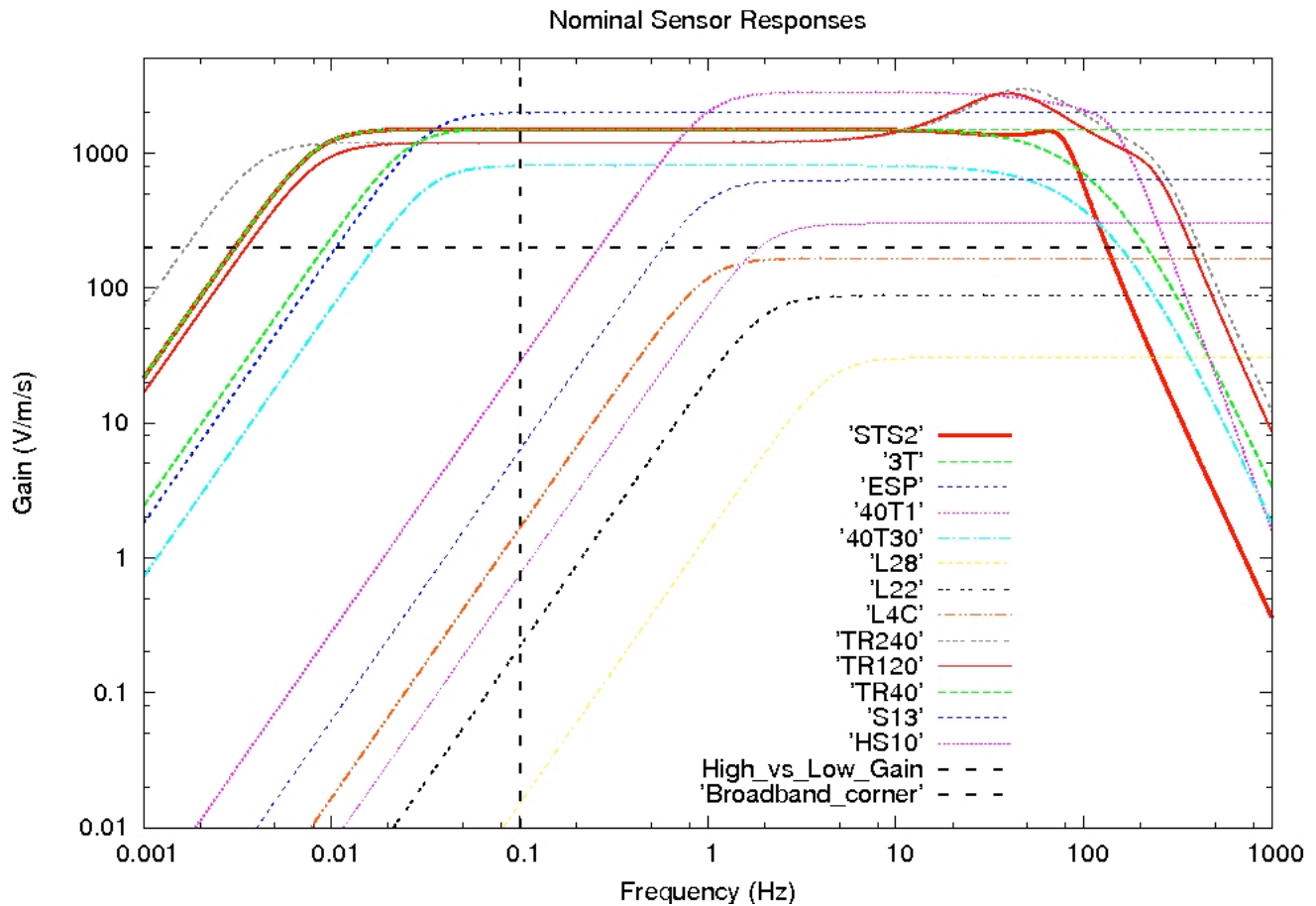


Figure 1. General responses of many of the sensors available from PASSCAL. The black horizontal and vertical dash lines indicate the suggested division between low and high gain instruments and the SEED manual division between broadband and short-period sensors respectively.

Notes regarding recommendations:

A gain of 250 V/m/s was somewhat arbitrarily chosen as the division between 'High gain' and 'Low gain' for our velocity sensors (the SEED manual does not quantitatively define High and Low gain). Those sensors with a gain of 250 V/m/s and higher would use 'H' as the instrument code of the channel name, those less than 250 V/m/s would use 'L'. This division places the STS-2, Guralps, Trilliums, S-13, and HS-10 in the high gain regime (for SEED channel naming) and the Mark Products sensors in the low-gain regime. [Note: the HS-10 is rarely shipped by PASSCAL; a search of the DMC's database shows the HS-10 (gain = 300 V/m/s @ 10 Hz) has been archived as a high gain sensor. The choice of 250 V/m/s therefore is consistent with the only instrument code used for previous submissions of HS-10 data.]

For consistency with the SEED manual, "L" is recommended as the instrument code for the 4.5 Hz geophone sensor, though in practice it is considered a geophone. The SEED manual recommends "P", the geophone code, for sensors with a natural frequency of 5 - 10 Hz and higher.

For accelerometers, the use of the broadband band codes, "H" and "B", for the band code of the channel name are recommended. While the term "broad-band" typically is with respect to the flat portion of the response curve of velocity sensors, its use is logical for accelerometers when one considers their responses are flat with respect to acceleration.

How to Build a Batch File

The batch file is the backbone of your database. It is the basis for **dbbuild** to construct the database. The batch file also serves as an historical record of your network configuration; therefore it should contain all the changes and additions associated with every one of your stations. Below you can find detailed description of what each field in the batch file means, and examples of batch file contents.

1. Network code <net>: Two (2) alphabetical characters assigned by DMC at start of deployment.
Example: XN, YD, PI

Make sure you have a network code. If not, and your experiment is a PASSCAL experiment, please request it from the mobilization and network code request form at <http://www.passcal.nmt.edu/pihomepage>. Otherwise, request a code at <http://www.fdsn.org/getcode.html>.

2. Station name <sta>: Up to five (5) alphanumeric characters; no special characters allowed:
Example: STA01, NP00, Y2CC

3. Location: Latitude, longitude and elevation – in kilometers:

Example: -77.72237 162.27354 0.042

4. Staname – A long, descriptive name for the station:

Example: M-mountain Socorro

5. Time Start configuration - Make sure the starting time is exactly the same or earlier than the first trace sample for each station:

Example: time 07/26/2004/ 21:00:00

6. Datalogger code –refers to the type of datalogger you used for the station:
Example of datalogger line in batch file:
datalogger Passcal_q330_linear 0984

Note: For the specific name of different types of digitizers and sensors, go to
/opt/antelope/ current_version /data/responses &
/opt/antelope/ current_version /data/instruments/dataloggers or

/opt/antelope/ current_version /data/instruments/sensors. There you will find the different response files (and the correct names) to be added to the batch file. If the response file is not in the default directory, please let us know and we will work with you to build the required file.

Example of sensors and dataloggers files: rt130, Passcal_q330_linear, cmg3t, cmg40t, cmg40t_1s, l22, cmg3esp, and sts2

7. serial number [dlsta] – serial number for the datalogger

Example datalogger: Passcal_q330_linear 0984
(from the example above)

8. Sensor – please select the type of sensor for each station.

The description used for digitizers and sensors will call the associated response file and description from the directories mentioned above.

Example of this line in the batch file:

In the batch file:	sensor	l28	0	0001
What it means:	sensor	model-code	emplacement-depth	serial-number [loc]

code edepth serial-number [loc] : Amend the edepth, serial number, and/or loc code for the sensor code. Note that this syntax does not provide for a case where multiple sensors of the same name are connected to a single datalogger.

a. The code must be chosen from the filenames of the sensor parameter files in the dbbuild database. **Dbbuild** uses the corresponding parameter file to fill in other values and configure itself for the chosen sensor. The emplacement depth and serial number are also specified on this line, along with an optional location code.

Antelope has a set of responses for most common sensors and digitizers. However some sensors have specific features (sensitivity, poles and zeros, etc) so make sure the description you select truly describes the instruments on your station. Streckeisen sensor response is very uniform, but Guralp sensors may have some exceptions:

Example:
/opt/antelope/current_version/data/responses/cmg3t

- Standard cmg3t – 120 seconds - Sensitivity 1500 V/m/sec

Other cmg3t descriptions:
/opt/antelope/current_version/data/responses/cmg3t_30sec
/opt/antelope/current_version/data/responses/cmg3t_360sec
/opt/antelope/current_version/data/responses/cmg3t_60sec

/opt/antelope/current_version/data/responses/cmg40t :

- Standard 30 sec cmg40t; Sensitivity 800 V/m/sec

Other cmg40t descriptions:

/opt/antelope/current_version/data/responses/cmg40t_1 :

- Guralp 40T-1 1 Hz sensor; sensitivity 2000 V/m/sec

/opt/antelope/current_version/data/responses/cmg40t_1_hi

- Guralp 40T-1 1 Hz sensor; sensitivity 4000 V/m/sec

If you are not sure about the description of your sensor you can request the response file from Guralp (caldoc@guralp.com). This is where we get the response files for the proper antelope format.

- b. The emplacement depth is normally 0 for deployments at the surface (vs. in boreholes)
- c. Sensor serial number

We are working on developing a system to request data by serial numbers. It will be helpful to track the historical behavior of particular sensors. Please note that the sensor serial number is not the same as the barcode number!

- d. Location code (optional, and not preferred)

The location code is merged with the SEED code to create the CSS 3.0 channel code. This is necessary in various situations. For example, if a borehole instrument and a surface instrument both use the same channel names.

10. Sensor Orientation - description from the man page for dbbuild_batch :

axis label hang vang [sens [lead [pgain [pstage]]]]

axis2 label hang vang [sens [dlgain [pgain [pstage [lead]]]]]

Default axes are specified in the sensor parameter file. However, instruments may be oriented differently in some circumstances, and it may be necessary to change the label (usually Z, E or N) and the corresponding orientation angles. In these cases the label in this command takes a different form:

old->new

For example, "E->1" to change from the default label "E" to the special label "1".
Optionally, one may enter

- An individual sensitivity sens for this sensor axis
- An individual datalogger gain (dlgain) for this datalogger input lead
- An optional pre-amp gain pgain
- An optional pre-amp stage pstage (with corresponding response file)

- A lead code identifying which datalogger lead this axis is connected to. This is required when the datalogger gain is to be looked up in a separate serial-number specific parameter file.

Each axis statement specifies settings for the selected instrument and the axis with the currently specified label. To simply associate a sensor axis with a particular set of leads, as when the actual sensitivities and dataloggers gains will be looked up in a serial number specific parameter file, you might use an axis statement like this:

axis N - - - ch2

Example:

Standard Orientation	Non-standard					
axis Z 0 0 - 1 1	axis Z	0	0	-	1	32
axis N 0 90 - 2 1	axis N->2	325	90	-	2	32
axis E 90 90 - 3 1	axis E->3	55	90	-	3	32

11. Sample rate – taken from the digitizer, this will determine the channel name according to SEED format. You can have more than one sample rate description for the same station. Please refer to the man page for dbbuild_batch if you would like more details.

Example: samplerate 1sps

12. Channel description: MSEED channel names are defined by the sample rate, instrument (i.e. sensor) type, and channel orientation. Please refer to the Seed Reference Manual V2.4 Appendix A for more detail.

In the batch file defined by a line like:

Example in the batch file: channel Z EPZ

What each field means: channel axis-label chan loc [dlchan]

Where :

channel: part of the template to defined the channel

Z : Axis

EPZ : Label (based on SEED convention)

Loc : absent in this example, PASSCAL does not require location codes unless there are more than one sensor at the same station, or by PI preference.

13. add - Add the current configuration to the database

14. close time – When the experiment ends, or there is a need for changing the configuration in one or more of the stations in your network, you can use the following statements to define specific configurations during a time frame:

close sta time : Turn off the station with code sta as of the specified time.
close sensor sensor time : Turn off a particular sensor at the selected station
close datalogger datalogger time : Turn off the datalogger at the selected station
Example: close NP00 12/31/2007 23:59:59

❖ IMPORTANT

When building your database in antelope, please take a moment to identify the response associated to your instrument.

- 1) If you are not sure about the response and you have a GURALP sensor, page 19 may help you to identify the response file you need to use when building your database. Please contact data_group@passcal.nmt.edu, we will help you if there is any question/doubt about which instruments you have on your experiment.
- 2) If you have an STS2 or any other sensor described under \$ANTELOPE/data/responses, these files haven't been modified and are standard. If you are uncertain which STS-2 generation you might have (there are three), use the sensor's serial number at this website for clarification: <http://www.passcal.nmt.edu/content/sts2-generations>
- 3) If you have a sensor or digitizer that is not described on ANTELOPE, you will need to find these responses (poles and zeroes) and create the two necessary files in antelope, feel free to contact me at eliana@passcal.nmt.edu if you need any assistance. The two files that need to be created are under:

Poles and zeros: \$ANTELOPE/data/responses
Descriptor file: \$ANTELOPE/data/instruments/sensors

Suggested reading:
Man page for dbbuild_examples, dbbuild

REVIEW Q330 SOH and WAVEFORM CHANNELS

	Channel Name	Conversion	Description
State of health channels (SOH)	ACE	miniseed; not a time series	VCO quality expressed as SEED timing blockette 500
	LCE	1 microsecond / count	Absolute clock phase error
	LCQ	1 % / count	Clock quality GPS lock interval (pql -m filename)
	LOG	miniseed; not a time series	State of health expressed as ASCII miniseed records Largest time jump after initial lock/adjustment (qlog logfilename grep -i jump)
	OCF	miniseed; not a time series	Q330 configuration parameters expressed as opaque data records (B2000)
	VCO	Count / count	VCO control voltage
	VEA	1 milliamp / count	GPS antenna current
	VEC	1 milliamp / count	Q330 system current
	VEP	150 millivolt / count	Input (system) voltage
	VKI	1 Celsius / count	Q330 system temperature
	VMU/VM1	100 millivolt / count	Boom position of Z or U component
	VMV/VM2	100 millivolt / count	Boom position of N or V component
	VMW/VM3	100 millivolt / count	Boom position of E or W component
	VPB	0.1 % / count	Q330 buffer usage Baler dump % or time interval (pql -m filename)
Waveforms	?H?	Trace sample rates : (mseedhdr filename grep sps) ; Station name in trace headers (sdrsplt -C filename) Network code in trace headers (sdrsplt -C filename) ; Channel name in trace headers (sdrsplt -C filename) Location code in trace headers (sdrsplt -C filename)	
	?H? & LOG	qlog logfilename grep -i "last boot"; qlog logfilename grep -i jump) **	

Table 2 – Q330 State of health channels and waveform channels – what they mean and how to look at them

POSSIBLE ISSUES WHEN EVALUATING SOH CHANNELS – Q330

CHECK	What - specifics	How to identify the problem	Suggestions
Timing issues	Timing errors larger than half the sample rate.	Use the pql to check clock quality SOH channels on Q330 (*LC*) <my_cpu> pql -m *LC*	Send us an e-mail: passcal@passcal.nmt.edu or data_group@passcal.nmt.edu . Describe the problem: send an example, log files, any information that can help to identify the problem and find a solution.
	No GPSLOCK, Timing questionable	Looking at the % of data quality in the log files <60% questionable	With fixhdr you can set up flags to the specific time. Please read the help for fixhdr, and identify time spans with questionable timing.
Check for power problems and system reboots	Is the voltage dropping down in time? How many reboots do you see in the logs? What are they related to?	Use pql to view the station's current, voltage, and temperature channels. <my_cpu> pql -m *.VE?* *.VKI* Use qlog to search for System Reboots. <my_cpu> qlog *LOG* grep -i "last boot" more	This helps mainly to keep in mind for further services. Feel free to e-mail us at: passcal@passcal.nmt.edu or data_group@passcal.nmt.edu
Geographic location	Just to know the location from the log files	Use qlog to identify location as follows: <my_cpu> qlog *LOG* grep "(Latitude: Longitude: Height:)" more	
Averaging geographical location	Using gpsq330locate (contributed antelope software from Gary Pavlis) <my_cpu> man gpsq330locate q330gpslocate - estimates station location from Q330 log file		
Endianess	Everything should be BIG endian	Using fixhdr, build a db and check Endianess. If BIG endian, data are OK. If not BIG, please convert from little to big endian. You may run into this issue if you processed your data on a Linux machine or an Intel Mac.	

Table 3 – Q330 channels - What to look at from the state of health channels and waveforms.

LOGPEEK for RT130 LOG FILES

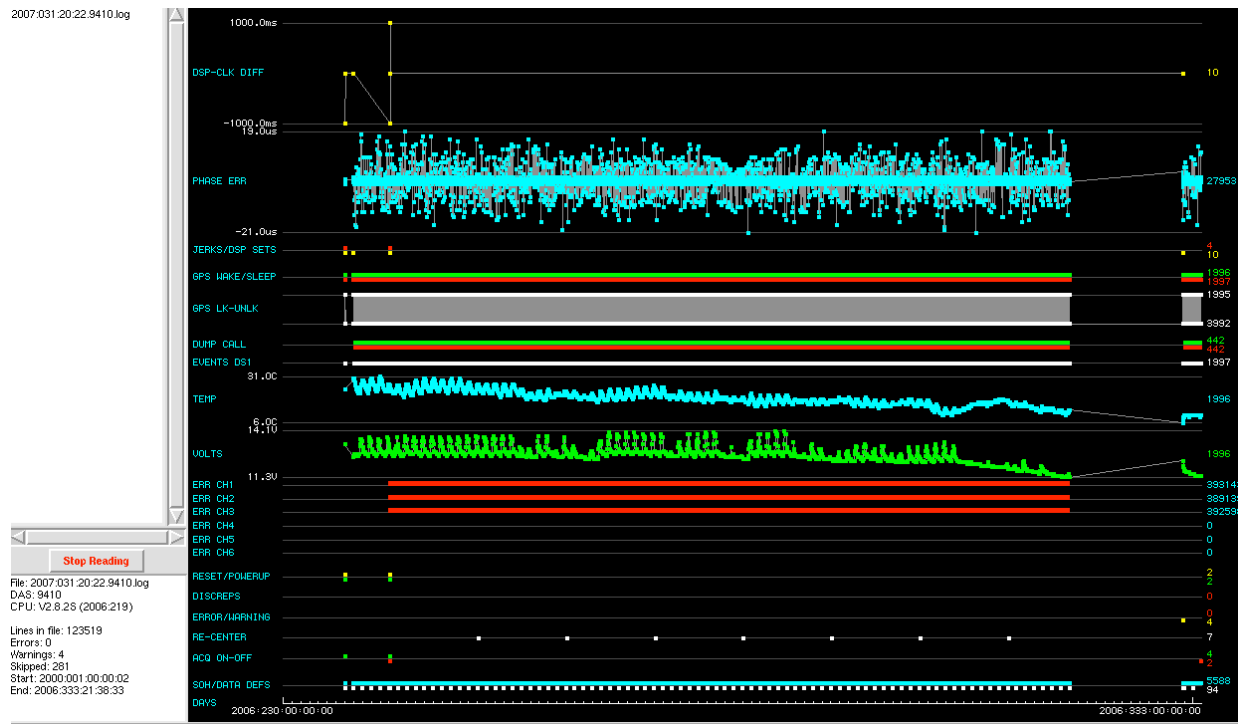


Figure 2. Logpeek display for a rt130 digitizer serial number 9410.

	TIMING MESSAGES	WHAT IT MEANS	From man logpeek (Bob Greschke)
LOG FILE	DSP-CLK DIFF	This is the Digital Signal Processing chip that samples the analog data. The DSP clock resets every time a time jerk occurs. Since the DSP includes a separate counter for seconds and milli-seconds, the reset may occur in two steps.	Points on this graph are generated by lines in the log files like: 172:01:41:21 DSP CLOCK DIFFERENCE: 0 SECS AND -989 MSECS. This graph will only be displayed if these messages are in the log file.
	PHASE ERROR	Reports the difference between the internal and external clock. Small errors (in microseconds) indicate that external and internal clocks agree. Errors in the order of milliseconds are written when a clock has been unlocked for some time and then locked. If large enough, these should be associated with time jerks.	Points on this graph are generated by lines in the log file like: 172:02:41:19 INTERNAL CLOCK PHASE ERROR OF 3526 USECONDS
	JERKS/DSP SETS	This is a reset of the internal clock. It usually occurs if the phase error between the external and internal clock exceeds the limits of -5 and +11 milliseconds.	Points on this graph are generated by lines in the log file like: 172:23:41:44 INTERNAL CLOCK TIME JERK # 11 OCCURRED AT 23:41:44.994 172:23:41:45 DSP CLOCK SET: OLD=01:172:23:41:45.996, NEW=01:172:23:41:45.007
	GPS WAKE/SLEEP	Shows GPS status.	Points on this line are generated by lines like: 173:00:39:58 GPS: POWER IS TURNED ON

		(72-series instruments) 173:00:39:58 EXTERNAL CLOCK WAKEUP (RT130-series instruments)
GPS LK-UNLK	GPS LOCK – means the external GPS clock is synchronized to the GPS satellites. GPS UNLOCK – If larger than the manufacturer specifications of +/- 0.5 ppm (+/- 40 milliseconds/day) perhaps you should consider for how long this happened, and if there are important events you would like to correct.	Points on this graph are generated by lines like: 173:00:41:53 EXTERNAL CLOCK IS LOCKED 173:00:46:53 EXTERNAL CLOCK IS UNLOCKED
DUMP CALL	DUMPING	Points on this line are generated by lines like: 173:01:17:25 AUTO DUMP CALLED 173:01:18:03 AUTO DUMP COMPLETE
EVENTS DS1	Refers to recorded events for each data stream.	Points on these lines are generated by lines like: DAS: 0108 EV: 0377 DS: 2 FST = 001:173:01:09:51:447 TT = 2001:173:01:09:51:447 NS: 144005 SPS: 40 ETO: 0 Which line a point is plotted on is determined by the data stream value following "DS:" in the log file line.
VOLTS	VOLTAGE	Points on this graph are generated by lines like: 173:02:17:04 BATTERY VOLTAGE = 13.5V
TEMP	TEMPERATURE	Points on this graph are generated by lines like: TEMPERATURE = 28C
RESET/ POWERUP	Indicates when resets or power ups happened during recording time.	
DISCREP	If any time discrepancies occur they will be shown here.	
ERROR/WARNINGS	Lines are placed in the log file by programs like ref2segy that have the word "ERROR" or "WARNING" in them. The position of the dots on the graph for these messages may, at times, not make any sense. These message lines in the log files do not have a time stamp, so the program just uses the time from the last line that had a time stamp, which, since a lot of the warning messages have to do with clock problems, means that the dots will show up in the wrong place.	
	RE-CENTER	Indicates manual re-centering during recording. Also shows programmed or configured center commands. Generated by lines in the log file like: 086:16:04:36 SENSOR 1 MASS RE-CENTER: MANUAL
	ACQ ON-OFF	Reflects times when acquisition started or stopped. Points on this line are generated by lines like: 159:15:09:11 ACQUISITION STARTED 253:22:57:43 ACQUISITION STOP REQUESTED
	SOH/DATA DEFS	State of Health Data Definition SOH points on this line are generated by lines like: State of Health 01:159:15:06:02:839 ST: 0108 Data Definition points on this line are generated by lines like: Data Stream Definition 01:159:15:08:59:392 ST: 0108 This block of information is normally followed by lines for the other parameter blocks such as: Station Channel Definition 01:159:15:08:59:392 ST: 0108 Calibration Definition 01:159:15:08:59:392 ST: 0108
	NET UP/DOWN	Indicates when acquisition was started or stopped From message: 277:20:37:06 RTP: Network layer is UP! 3:20:00:40 ACQUISITION STOP REQUESTED 053:20:00:40 ACQUISITION STOPPED
	DAYS	Indicates time span of data recording.

File: 2007:065:15:36.9BC4.log	File name
DAS: 9BC4	Datalogger associated to the file
CPU: V2.8.2S (2006:219	Current firmware on DAS
Lines in file: 170023	Count of lines on log file
Errors: 0	Count of found errors
Warnings: 0	Count of found warnings
Skipped: 2	
Start: 2006:277:20:36:39	Time of first record
End: 2007:053:20:00:40	Time of last record

Table 4: Logpeek messages and what they mean

CHECK	Specifics	How to identify problem	How to fix it	Other suggestions
Timing issues	Timing errors larger than half the sample rate.	Use logpeek to check clock quality: <my_cpu>logpeek	Send us an e-mail to passcal@passcal.nmt.edu or data_group@passcal.nmt.edu describing the problem. Send an example, the accompanying log files, and any other information that can help to identify the problem so we can find a solution.	
	No GPSLOCK, Time questionable	Significant time spans without having gps locked	With fixhdr you can set flags to the specific time range in question. Please read help for fixhdr to identify time spans with questionable timing.	
Check For Power Problems and System Reboots	Does the voltage drop over time? How many reboots do you see in the logs? What are they related to?	Use logpeek to view the station voltage and temperature	This helps mainly to keep in mind for further service runs. Feel free to e-mail us a description of the problem: passcal@passcal.nmt.edu or data_group@passcal.nmt.edu	
Averaging geographic location	<p>From Noel Barstow: You can get information from the RT130 positions in either of 2 ways, described below. BUT, we also like people to use a good handheld GPS at the site to compare to. Earlier versions of RT130 firmware did not yield good locations because they did not power the clock long enough to get a lot of satellites. Fortunately, your RT130's are running CPU firmware version 2.8.2s, so your locations should fairly good.</p> <p>1) Get location through the logpeek program. Choose the 'Windows' option at the top, and then 'GPS Plot' and you will get a graph and statistics. (Statistics copied below for a sample station in Africa.)</p> <p>Logpeek -> Windows -> GPS Plot Statistics look like this: Points plotted: 1165 of 1249 Mean location: Lat: 6.225 Long: 10.054 1 sigma degrees: Lat: 7.30E-06 Long: 1.49E-05 1 sigma meters: Lat: 0.81m Long: 1.65m Elevation: +594.92m</p> <p>2) Get location via a program called 'position' which uses the same info from the logfile. Example below with output for same station in Africa, so you can compare.</p> <p>prompt> position s6-cm20-2007:046:19:45.9290.log position: Version Number 2002.058</p> <p>s6-cm20-2007:046:19:45.9290.log Time of First Position 331:10:13:44 Time of Last Position 018:08:03:53 Average position 6.22522, 10.05368 Number of positions 1249 Standard deviation 4.85 in meters Elevation average: 594.000000 std dev: 4.820579 MEDIAN position 6.22522, 10.05367 307 outliers (greater than one L1-sigma from median) removed. New Average position 6.22522, 10.05368 Number of positions 942 New Standard deviation 4.53 in meters</p>			

Table 5: Logpeek errors and GPS locations

Troubleshooting & identifying errors

Table 6: Possible errors you may find when running miniseed2days

POSSIBLE PROBLEM	SOLUTION/APPROACH
Did not find files	Verify path of where your files, waveforms, pf files are located. Please check paths where your mseed data are, and the new wfname file-naming convention specified with the -w option.
Cannot find miniseed2days or any other antelope tool	<p>miniseed2days is part of the antelope distribution so if antelope is installed it should be available.</p> <p>Check if you can do man on miniseed2days or any other tool.</p> <p>Verify that antelope is sourced, if not source it (source /opt/antelope/current-version/setup.csh or .sh) depending on your preference or platform</p> <p>Verify antelope installation (run check_antelope_installation from the command line) if ok, check path or source</p> <p>Verify your license (run check_license from command line)</p>
Bad blockettes	<p>Some miniseed files may have an error/warning about bad blockettes or out of order blockettes, when this happens sometimes by using miniseed2days with the -DU options (please see man page for detail) will let you pass over this warning.</p> <p>Feel free to contact us if more questions about it.</p>
Bad Quality	<p>QT1395090109.ALL miniseed2days: bad clock quality = 0 : dropping blockette #1 for QT_1395_BHZ_o QT1395090109.ALL</p> <p>SOLUTIONS</p> <p>1)Use the option -k (retain all input data blocks, regardless of clock timing quality values) will allow you to generate mseed day volumes.</p> <p>miniseed2days -k -d my_db -w "day_volumes/%{sta}/%{sta}.%{net}.%{loc}.%{chan}.%Y.%j" my_raw/</p>
Out of order block	<p>The error may look like: miniseed2days: appending to ./day_volumes/1395/1395.QT..OCF.2009.009 miniseed2days *fatal*: block #6 (QT_1395_OCF_, t= 1/09/2009 (009) 21:05:59.000) is at or before the previous block for this</p>

channel.

Solution: Using the `-DU` or `-Du` (depending on how strict you want to run this options) option will keep record of the time previously written data block and will not write a second block with the same or previous time.

The command line should look like :

```
miniseed2days -k -Du -d my_db -w
"day_volumes/%{sta}/%{sta}.%{net}.%{loc}.%{chan}.%Y.%j"
my_raw/
```

for more details please read man page on miniseed2days

What do to when would like to avoid the long command line when running miniseed2days

```
miniseed2days -d my_db -w "day_volumes/%{sta}/%{sta}.%{net}.%{loc}.%{chan}.%Y.%j" my_raw/
```

If you have root permission on to write under `/opt/antelope/current-version/data/pf` you can simply edit the pf file for miniseed2days changing the default for wfname
From:

```
wfname %Y/%j/%{net}_%{sta}_%{chan}_%{loc}.msd
minimum_timing_quality 10
```

```
pf_revision_time 1237332028
```

to:

```
wfname mseed_dayv_s1/%{sta}/%{sta}.%{net}.%{loc}.%{chan}.%Y.%j
minimum_timing_quality 10
```

by editing this file and changing the wfname default you will avoid having to use the `-w` option in the command line so now you can simply type in the command line:

```
miniseed2days -d my_db my_raw/
```

You may need to edit this file each time you have a new service so each set of day volumes for each service is name accordingly, for example for service2 , you'll edit:

```
wfname mseed_dayv_s2/%{sta}/%{sta}.%{net}.%{loc}.%{chan}.%Y.%j
minimum_timing_quality 10
pf_revision_time 1237332028
```

... and so on.

If you don't have root permission to write under `/opt/antelope/4.11/data/pf` then proceed as follows:

- 1) Copy default file in your local directory where you will run miniseed2days:

```
<my_cpu:my_experiment> cp /opt/antelope/current-version/data/pf/miniseed2days.pf .
Please notice the dot at the end of the command (for copying locally)
```

- 2) Edit the miniseed2days.pf file as above
- 3) Set the PFPATH environment (path for parameter files in antelope)

```
<my_cpu:my_experiment> setenv PFPATH $ANTELOPE/data/pf:.
```

Please notice the “.:” used to read defaults parameter files (under /opt/antelope/current-version/data/pf) PLUS customized file (your miniseed2days.pf file in local directory)

- 4) Run **miniseed2days** as:

```
miniseed2days -d my_db my_raw/
```

Table 7. Possible errors when evaluating traces with dbeditor/dbpick

Check	Issues on traces	Comments
dbe (db editor)	Coverage	Helps to visualize completeness per station/channel/network in the wfdisc table
	Overlaps	Usually generated when traces added more than once to the db. Highlighted in orange when viewing waveforms (dbpick)
	Gaps	Helps to identify data missing from the db. These can either be overlooked traces or real gaps.

Table 8. Possible errors when running dbverify – consistency and checks of integrity of information in database and traces

Check	Issues on traces & meta-data	Comment
dbverify	1) Non-described channels/stations	Comparing cmd output & batch file to identify the reason for this warning
	2) Multiple configurations for same time frame	Mainly due to bad closing times in the batch file or multiple configurations for the same station in one day without proper closing
	3) Removed files	Missing files in original path
	4) Duplicate record	Same record in multiple wfdisc entries

Examples of some of these common issues:

1) Problem: Non-described channels/stations

Example of output:

The following records of AGU_PIC.wfdisc did not have corresponding rows in sensor:

Record #149 : sta = BHM8 chan = BHZ time = 8/12/2009 1:16:34.000 endtime = 8/13/2009 1:50:34.000

Record #150 : sta = BHM8 chan = BHZ time = 8/15/2009 3:04:24.000 endtime = 8/16/2009 3:39:44.000

Possible solutions:

- Evaluate your batch file and the configuration described for this station & check:
 - a. station configuration
 - b. start/end times
 - c. channel description
 - d. location code if use in batch or trace
 - e. sample rate (s)
 - f. Once mismatching information is identified, edit batch file & rebuild db

2) Problem: multiple configurations for same station/day

Example of output:

Comment check that **calib doesn't change in the middle of a waveform**

dbopen calibration dbjoin wfdisc sta chan time

#time::endtime dbverify 0 sta chan time wfdisc.time wfdisc.endtime

Record # 0 : sta = BARR chan = BHE time = 4/12/2009 0:00:00.000 endtime = 12/31/2009 23:59:58.999
0

BARR BHE 1239494400.00000 4/11/2009 16:40:45.525 4/12/2009 0:00:27.600

Record # 1 : sta = BARR chan = BHN time = 4/12/2009 0:00:00.000 endtime = 12/31/2009 23:59:58.999
0 BARR BHN 1239494400.00000 4/11/2009 16:40:45.525 4/12/2009 0:00:32.500

Record # 2 : sta = BARR chan = BHZ time = 4/12/2009 0:00:00.000 endtime = 12/31/2009 23:59:58.999
0 BARR BHZ 1239494400.00000 4/11/2009 16:40:45.525 4/12/2009 0:00:06.475

Possible Solutions:

- Read output and try to identify the records or field it refers to.
- Verify time when configuration changed for station (i.e. BARR).
- Check/add closing statements for station configurations.
- Rebuild your database.

3) Duplicated wfdisc records

Example of output:

Keys for records #274072 and #274073 in table wfdisc match:

sta ABRA | ABRA chan BHE | BHE time 1/01/2009 0:00:41.050 | 1/01/2009 0:01:06.525 endtime
1/01/2009 0:01:07.500 | 1/01/2009 0:01:07.500

Possible Solutions:

- Open the table in question with dbf (usually wfdisc)

- Identify reported records (i.e. 274072 & 274073)
- Plot and identify if overlaps are simply due to buffer packing
- If significant overlap, remove duplicated records
- If resulting from buffer packing - ignore

4) Dbverify :missing wfdisc files - Files that were added to the database cannot be found in their original location

Example of output:

Waveform file 'MSEED/SC44.XR..BHE.2008.220' does not exist.

Waveform file 'MSEED/SC44.XR..BHE.2008.221' does not exist.

Waveform file 'MSEED/SC44.XR..BHE.2008.222' does not exist

Possible solutions:

- Move the files back
- Fix the chanids (dbfixchanids)
- Removed the wfdisc table and add the traces again if needed
- Do nothing - sometimes traces are moved on purpose to open space.

Table 9. Possible errors when verifying the database with dbversdwf

Check	Issues	Comments
dbversdwf	BAD records	<p>Command line: dbversdwf -dtu your_db > dbversdwf.out</p> <p>These warnings are usually associated to:</p> <ul style="list-style-type: none"> •Bad endianness •Bad logical record •Steim compression issues •Corrupted blockette

Possible Solutions:

- Look at the traces with any viewer (e.g. pql) to identify issues
- Move bad records aside-remove from db
- Run ckMseed to identify bad traces/errors
- Use mseedhdr to look at order of the trace
- Use fixhdr if needed, to change endianness
- Once fixed (if possible) add back to your database

Table 10. Possible errors when generating database from dataless or when generating dataless

error	output	solution
Missing originating_organization	<p>Command line:</p> <p>1) To generate database from dataless: db2sd -v YoseRocks_dataless X7.08.YoseRocks.20090281014.dataless</p> <p>db2sd *fatal*: Please fill in the 'originating_organization' in db2sd.pf</p> <p>or</p> <p>2) To generate dataless from database</p> <p>Command line: mk_dataless_seed -v YoseRocks_dataless X7.08.YoseRocks.20090281014.dataless</p> <p>db2sd *fatal*: Please fill in the 'originating_organization' in db2sd.pf</p>	<p>Under the directory: \$ANTELOPE/data/pf/ You may need to edit the file site.pf to add the originating_organization.</p> <p>An example of the site.pf file at PASSCAL looks like:</p> <pre> default_seed_network PI Institution IRIS PASSCAL originating_organization IRIS PASSCAL mail_domain passcal.nmt.edu mailhost mail.passcal.nmt.edu </pre>
Exact same locations for more than one station	<p>db2sd: Offending wfdisc row is T2S6:VMW 12/16/2004 12:38:28.000 db2sd: Multiple sensor/site/sitechan entries for wfdisc record db2sd: Offending wfdisc row is T2S6:VPB 12/16/2004 12:38:28.000 db2sd *fatal*: 240 problems -- won't create SEED volume</p>	