# Data Playback

## Introduction

### Purpose

This document is intended to familiarize the new user with the various programs included in the Data Playback Package.

### References

Please refer to the following sources of additional information as appropriate:

1. The Software Installation section of the Reference Manual provides specific instructions for the initial system installation.
2. The Software Reference Manual provides a thorough discussion of each Nanometrics program, describing all options, input parameters, etc.

## Description

### Overview

The playback package consists of software programs carrying out tasks from retrieving time series of seismic data and system state-of-health information from the NAQS ringbuffers to data conversion between Nanometrics data format and common data formats used in data exchange.

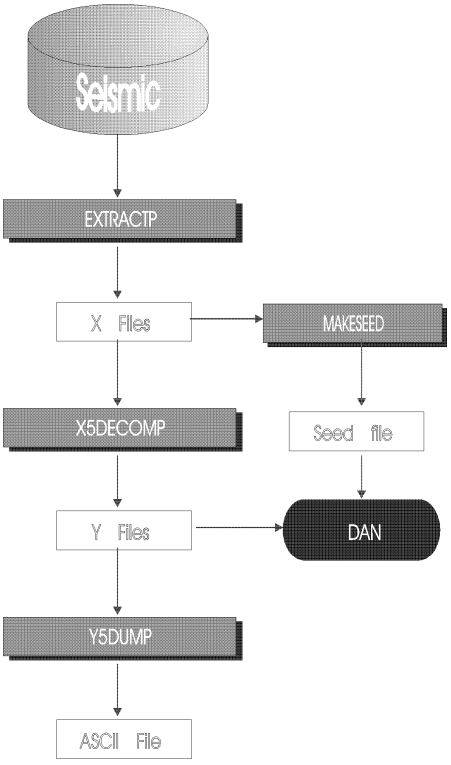


***Figure 1: Seismic data flow diagram***

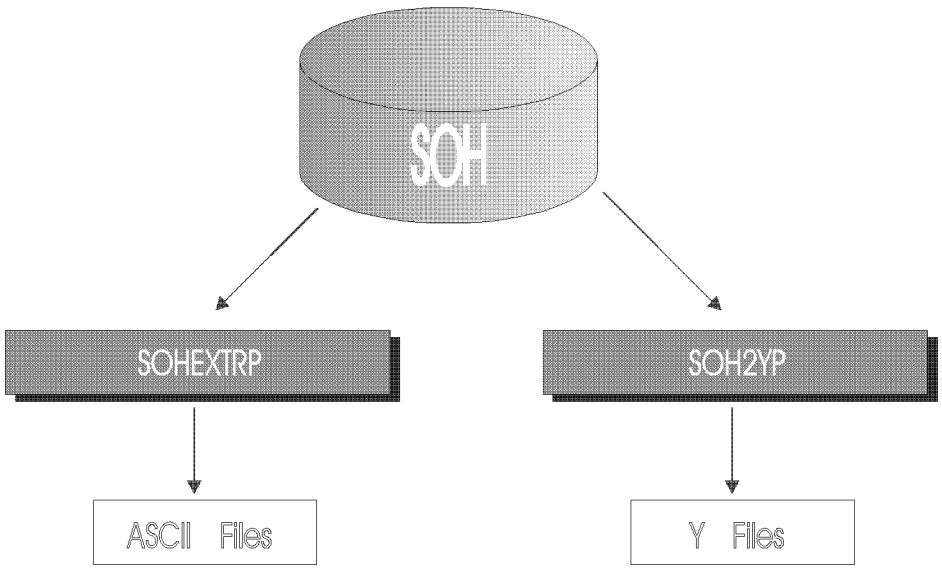


***Figure 2: SOH data flow diagram***

NAQS will create one ringbuffer for each channel of each station installed and configured in the naqs.stn file. Similarly, NAQS will create a separate SOH ringbuffer for each instrument installed on the network and configured in the naqsnt.stn file. Each instrument will generate its specific SOH information and send it to the central acquisition site in instrument/SOH channel specific bundle types.

The playback support contains programs corresponding to the tasks in the first stage transcribing data in the different private formats on the data cartridge to the public format. The files in public format are then ready for the users to edit directly or analyze using other utilities, such as DAN or any existing analysis software capable of reading the data in one of the formats produced by the Nanometrics conversion programs.

## File Format

### Private format

Data of private format are generated during the acquisition process. The format is designed with the consideration of making speed and disk space usage optimal. These private formats include:

- the time series ringbuffer,
- the state-of-health information.

### Public format

Data of public format are the end product of the data playback process. Users access the data via programs which extract or interpret the internal formats and generate data in public format. Nanometrics guarantees continuity in the way of forward and backward compatibility of the public format. The public formats include:

- X-file, each of which holds compressed time series data extracted from a ringbuffer file.
- Y-file, which is similar to an X-file except that data is decompressed into 32-bit binary integers.
- ASCII output of the state-of-health data, which contains one group of parameters in a format suitable for direct importation into spreadsheet programs.

Custom data conversion programs can be developed after consulting the Y-file format description in the Data Playback section of the Reference Manual and the Y5Dump source code included with the Data Playback software package.

### Data Access

A user can obtain X or Y files of the data in desired time duration or all data in a ringbuffer file using the extraction programs of the playback package.

#### Seismic Data

*Extract data*

EXTRACTP retrieves time series data from a ringbuffer file and writes them in X file format. Using different switches in the program, a user can obtain all time series data in a ringbuffer, data in a fixed time interval, data in certain events, or just obtain the acquisition information in a summary form. Once familiar with the options in the operation, a user can write his/her batch job script (available on the computer operating system) to do data playback repeatedly and efficiently. For users who have DAN (Nanometrics data analysis program) on OS/2, data extraction can be carried out by the on-line data function of DAN.

*Convert data in an X file to other data formats*

Programs X5DECOMP, MAKESEED, and Y5DUMP convert X-files created by EXTRACTP into Y-files, SEED, and ASCII format, respectively.

#### Programs for Other Data

*State-of-health*

SOHEXTRP retrieves the state-of-health data from the ringbuffers in private format and writes one group of similar parameters per file in ASCII files.

SOHTOYP retrieves the state-of-health data from the ringbuffers in private format and writes one SOH channel per file in Y files.

### Naming Convention of the Nanometrics Data Files

In most cases, examples in the reference manual of a program are given in the form applicable to the naming convention

Nanometrics software uses long filenames when supported on the host computer.

Note below that [component] is composed from the station name, location and the channel.

*X-files*

X[component]_yyyymmdd.hhmmss

*Y-files*

Y[component]_yyyymmdd.hhmmss

*SEED files*

S[component]_yyyymmdd.hhmmss

*SUDS files*

U[component]_yyyymmdd.hhmmss

*ASCII Y file dumps*

Y[component]_yyyymmdd.hhmmss.h for the header information
Y[component]_yyyymmdd.hhmmss.d for the time series data

## Components

### Extractp

EXTRACTP retrieves time series data from the ringbuffer files and creates one file per component in the case of multi-component extracts. The output file is in compressed X5 file format. The text

below is derived from the extractp on-line help commands. EXTRACTP operates in one of five modes as listed below.

**X5Decomp**

X5DECOMP decompresses input_file in the Nanometrics X5 data format producing a Nanometrics Y5 data format file in output_directory. The Y-file produced has the same filename as the input filename except the first letter is changed to a Y (by convention X-file filenames start with a X and Y-files with a Y). The X-files contain data in compressed Steim blocks, as created by EXTRACTP, while the Y-files contain data in uncompressed 32 bit long integers.

**SOHExtrp**

SOHEXTRP is used to extract various streams of information from the binary SOH data file.

**SOHToYp**

SOHTOYP is used to extract various streams of information from the binary SOH data file and convert them into Y files.

**Y5Dump**

Y5DUMP is used to dump a version 5 X or Y-file into ASCII format. However, only the header of the X-file can be dumped as the data is compressed.

**MakeSEED**

MAKESEED is a data conversion utility that creates SEED version 2.3 data volumes from Nanometrics X5 or Y5 files. The program reads in time series files and the system response file, and writes the SEED volume containing the SEED header and data in Steim compressed data format.

**Response**

RESPONSE generates a system response file, the content of which corresponds with the station response header information in the SEED (Standard Exchange of Earthquake Data) data volume. In order to use the program, a user must know the type of sensor, the sampling rate, and the frequency of the IIR filter of the acquisition system. The response file thus generated is a text file with a default name seed.rsp. It contains a number of stages describing the parameters of the sensor, analog-digital converter, and digital filters in the system. The stages for the Orion or HRD such as the FIR and IIR filters are exact. The sensitivity of the seismometer stage is the value after damping. The poles and zeroes in this stage are nominal values, and therefore, the operator may want to edit the file to put in the exact pole positions for the actual seismometers. The output of the program, e.g., seed.rsp, is used by MAKESEED to generate the system response information in a SEED data volume.

**Rbfsum**

RBFSUM is a utility program to create a daily or hourly summary of the contents of one or more seismic data ringbuffer files.

**Decim**

DECIM decimates the data to lower sample rate.

**HeadEdit**

*Headedit* is a utility program to edit the Y5 header of binary seismic data files (X5 files, Y5 files, and packet ringbuffers) in order to insert or change missing or incorrect information.

**RbTrim**

RBTRIM removes any unused space at the end of a ringbuffer file to reduce the file size before archiving.

# Tutorials

## Examine the State-of-health Information

### Extract SOH information

Change to the directory in which the SOH ringbuffers reside, and extract all the state-of-health information from the SOH ringbuffers into ASCII files in the same directory with the following command:

```
sohextrp *
```

The SOHEXTRP command syntax is given in the Sohextrp manual page in the Software Reference manual. To obtain command line help type in:

```
sohextrp | more
```

### Reading and Interpreting SOH Information

Depending on their size, the obtained files can be opened in a text editor or in a commercial spreadsheet program. In the latter, traces of various parameter variations in time can easily be plotted.

File naming conventions and format for each of the output files are described in detail in the SOH file description man page of the Software Reference/NAQS Server package..

### Statistics of the Communication Link

Use the RBFSUM program to obtain statistics of the communication link. Change to the directory containing the ringbuffers and type in the following command:

```
rbfsum * -d > rbfsum.log
```

The summary for each file is presented in a tabular format, showing for each day:

**a.** the number of seconds of data collected during the hour,
**b.** the percentage of the data that was received as retransmits (either requested or sent by transmit-twice option),
**c.** the number of seconds of data missed during the hour, and
**d.** the number of breaks in the data which started during the hour.

Repeat the command to obtain an hourly summary.

## Extract Seismic Data

### Retrieve the Span of Data in the Ringbuffers

Use the EXTRACTP program to obtain a summary of the contiguous data blocks contained within each seismic ringbuffer file. The EXTRACTP command line syntax is given in the Extractp manual page of the Software Reference manual. To obtain a command line help, type in, at a command prompt:

```
extractp -s -h full
```

Change to the directory where the seismic ringbuffers reside, and execute the following command to obtain a summary of the content of all ringbuffers:

```
extractp -s -i * > summary.xtr
```

The summary contains the beginning and ending time of the data in the ringbuffer. A time period reported as a gap indicates possible missing data packets.

### Extract Ad-hoc Time Series of Data

Use the EXTRACTP program to extract ad-hoc time series of seismic data. Change to the directory where the seismic ringbuffers reside, and execute the following command to obtain a 10 minute data segment recorded between 10:11 AM on May 25, 1998::

```
extractp -m 1998-05-25_10:11:00.000 -d 600 -i * -o c:\data\ -f
```

The data will be written in Xfile format to a c:\data directory.

### Extract all Data from the Ringbuffers

Use the EXTRACTP program to extract all recorded data. This might be needed if you would like to back up all recorded data on a different hard-disk before doing a system configuration change. Change to the directory where the seismic ringbuffers reside, and execute the following command to obtain all data in 1 hour segments with 1 minute overlap between the segments:

```
extractp -a -i * -o c:\data\ -f -p 60 1
```

A sub-directory will be created in the c:\data directory for each hourly segment and the data will be written in Xfile format.

### Extract Event Data from the Ringbuffers

Use the EXTRACTP program to extract the events. This is a very quick and efficient method of obtaining all event data with one single command without knowing the exact time and duration of each event which triggered the system. Change to the directory where the seismic ringbuffers reside, and execute the following command to obtain all events which start time and duration has automatically written into the naqs.elf file:

```
extractp -e -l c:\nmx\user\events\naqs.elf -s 60 -o 120 -i * -o c:\data\ -f -d
```

A sub-directory will be created in the c:\data for each event and the data will be written in Xfile format with one minute pre-event and 2 minutes post-event time. Please note that the name and the path to the NAQS event list file (elf) might be different depending on the customization of the system.

## Data Conversion

### Convert from X Format to Y Format

Use the X5DECOMP program to convert from X format to Y format which then can be read in the DAN analysis software or dumped in text files. Change to the directory where the X files are contained (let use suppose: c:\data), and execute the following command:

```
x5decomp -i c:\data\X* -o c:\ydata\
```

The data will be written in Y format in the c:\xdata directory.

### Convert from Y Format to ASCII

Use the Y5DUMP program to dump the Y files into text files. Change to the directory where the Y files are contained (let us suppose: c:\ydata), and execute the following command:

```
y5dump [yfilename] -d > [textfilename]
```

where yfilename and textfilename should be replaced with the correct names. The data from the text file should be read line by line.

### Convert from X Format to SEED

Use the MAKESEED program to convert the X files into a SEED file. First create a response file in the directory where the X files are contained (let us suppose: c:\data) by running the response program. Execute the following command in the c:\xdata directory:

```
makeseed c:\data\ -r c:\data\ -o c:\data\
```

The SEED file will be created in the c:\data directory.