



# EarthScope Consortium

## FIXHDR HELP

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### 1. Description

**fixhdr** is a PASSCAL software tool distributed with PASSOFT, used to modify miniSEED header fields, address timing issues, and change header endianness. It can be used either as a graphical user interface or from the command line (batch mode). This document describes usage and functionality of **fixhdr**. Note that **fixhdr** searches the specified directory and all its subdirectories for miniSEED files. **Unix commands (bold print)** and any **command line arguments are highlighted in yellow**. GUI options and menus are highlighted gray. Input files are denoted by <filename>.

**Warning:** Fixhdr is designed to modify miniSEED files that contain a single station (i.e. a single network, station, location, channel identifier). Modifying headers of multiplexed miniSEED files (i.e. files containing several stations) will result in the loss of header information.

## 2. Starting fixhdr & building trace database

Activate your PASSOFT conda environment and ensure that your version of PASSOFT is up-to-date. Instructions for installing, activating, and updating the PASSOFT package can be found on the EPIC website here: <https://www.passcal.nmt.edu/content/software-resources>

Once you have activated your PASSOFT conda environment, type **fixhdr** on the command line to start the GUI version of the program. By default, **fixhdr** opens with your current working directory populated in the Data Directories field, as shown in Figure 1.

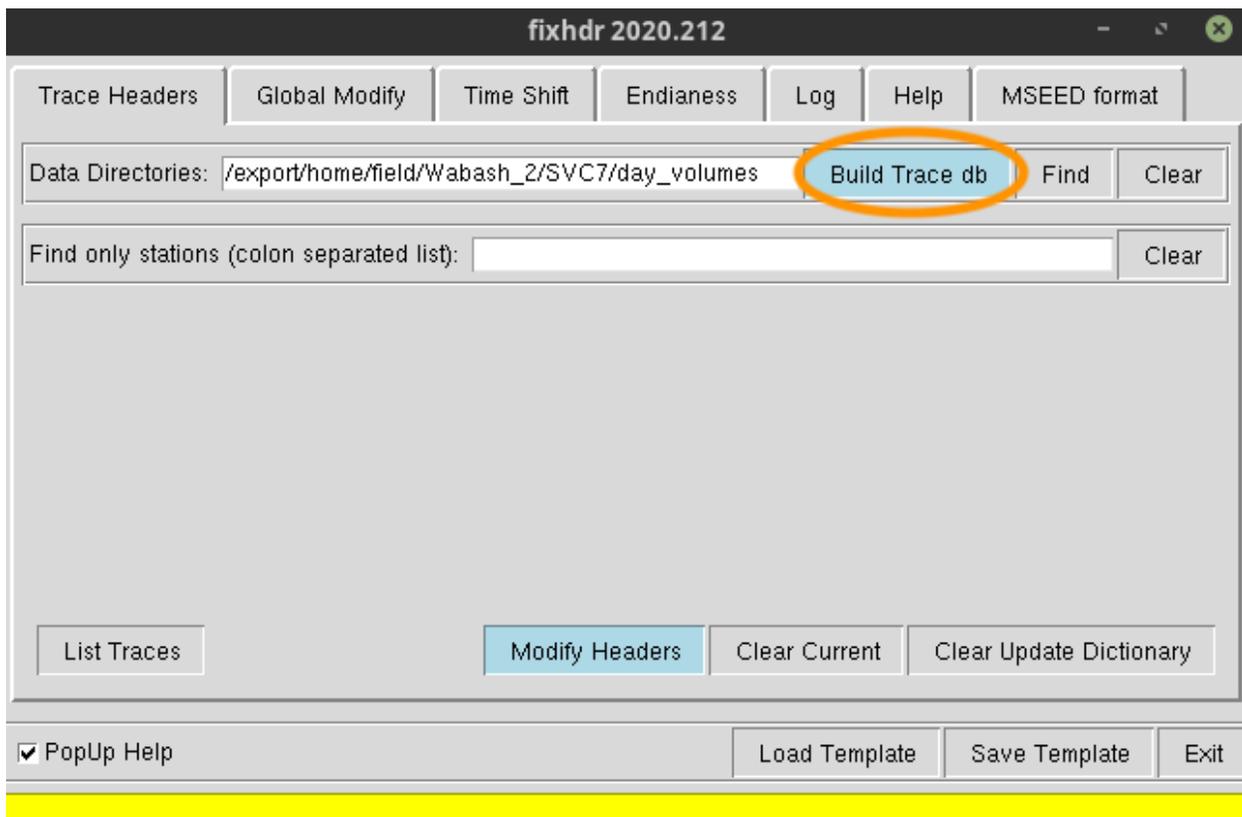


Figure 1 – Fixhdr main GUI window

If you need to change your data directories path, press the **Clear** button, then the **Find** button. If you do not clear the **Data Directories** field, **fixhdr** will add whatever directory or directories you choose in a colon-separated list and will search all of them to build the trace database (Trace db), as shown in Figure 2:



Figure 2 – Data Directories field

To load only one or a few stations, enter the station names in the **Find only stations** field (Figure 3)

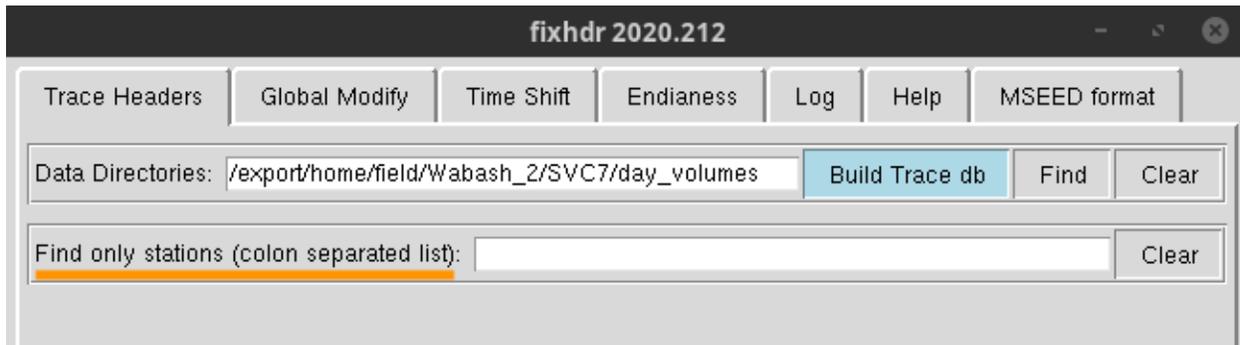


Figure 3 – Find only stations field

Once you are satisfied with data and directory selection, click the **Build Trace db** button. A pop-up message will appear with the status of reading trace header files:

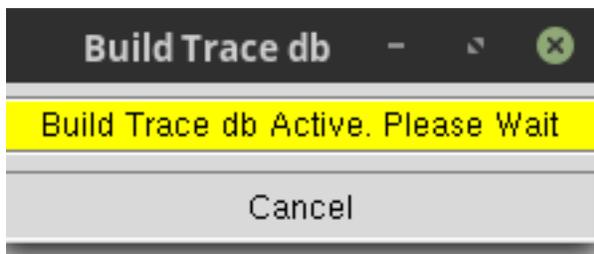


Figure 4 – Build Trace db pop-up message

- Note: Trace db build times vary: when searching 24 directories, it may take 3-5 minutes to build a trace db of ~12,000 files for the first time. However, when searching across >100 directories, it can take >30 minutes to build a trace db of ~6,500 files.

### 3. Changing file headers

#### 3.1 Single header value

When Build Trace db is done, the main **fixhdr** GUI will update and populate with all the station, channel, location, network and sample rate values found within the examined trace headers. Continue to use this section if you have one or a few changes to

make (for example, changing one channel name on one station). If you have changes to make across your entire trace db, please go to section 3.1. The `Stat:Chan:Loc:Net:Sps` drop down shows all the combinations found in the trace db (Figure 5):

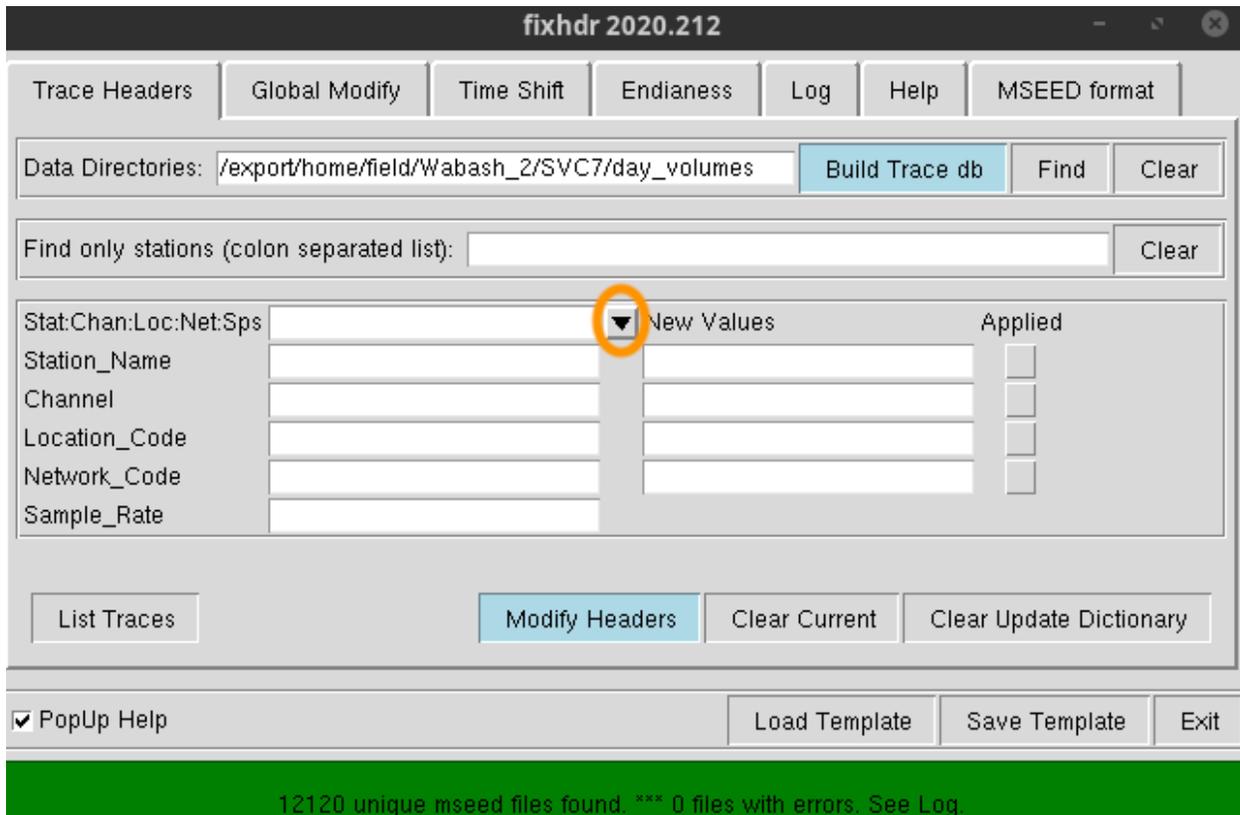


Figure 5 – `Stat:Chan:Loc:Net:Sps` drop down

By selecting a combination to modify, the `Station_Name` and other fields will be populated on the left column. Enter the `New Values` in the right column and press `Modify Headers` to apply changes (Figure 6).

Stat:Chan:Loc:Net:Sps	SH03:EHE::6E:100.0	New Values	Applied
Station_Name	SH03		<input type="checkbox"/>
Channel	EHE		<input type="checkbox"/>
Location_Code			<input type="checkbox"/>
Network_Code	6E		<input type="checkbox"/>
Sample_Rate	100.0		

PopUp Help

109 traces selected for key: SH03:EHE::6E:100.0

Figure 6 – Modify Headers button

Example: to change channel name from EHE to EH2 for station SH03, enter EH2 in the Channel row under the New Values (Figure 7):

Stat:Chan:Loc:Net:Sps	SH03:EHE::6E:100.0	New Values	Applied
Station_Name	SH03		<input type="checkbox"/>
Channel	EHE	EH2	<input type="checkbox"/>
Location_Code			<input type="checkbox"/>
Network_Code	6E		<input type="checkbox"/>
Sample_Rate	100.0		

Figure 7 – Changing single header value: channel name from EHE to EH2

Then, click the Modify Headers button. A pop-up and a progress message at the bottom of the main GUI show the modification process (Figure 8):

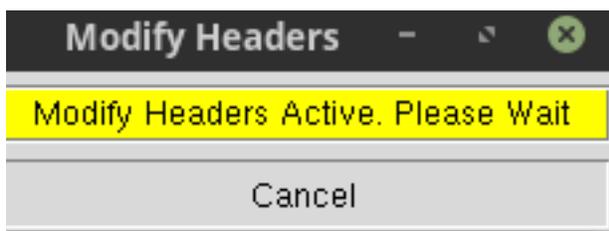


Figure 8 – Pop-up message indicating modification process

After all headers are modified, selecting the same station:channel:location:network:sample rate again (without rebuilding the trace db), will show the modified values while the box in the **Applied** column will now be green (Figure 9):

Stat:Chan:Loc:Net:Sps	SH03:EHE::6E:100.0	New Values	Applied
Station_Name	SH03		<input type="checkbox"/>
Channel	EHE	EH2	<input checked="" type="checkbox"/>
Location_Code			<input type="checkbox"/>
Network_Code	6E		<input type="checkbox"/>
Sample_Rate	100.0		<input type="checkbox"/>

Figure 9 – Green box next to newly modified header value indicating applied change

To apply other changes and modification to the header values you would need to rebuild the trace db, otherwise you will get a **Warning** message (Figure 10):

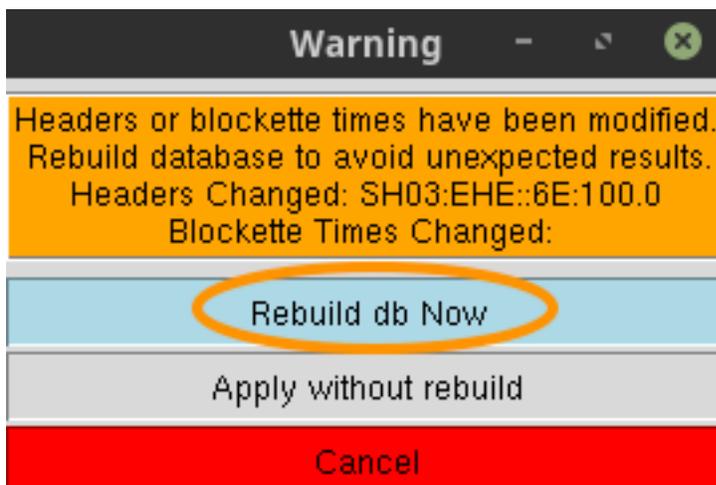


Figure 10 – Warning message

### 3.2 Using Global Modify

If you need to apply widespread changes to all or large portions of your data, such as renaming a network code, or converting all channels named EHE to EH2, you can use the **Global Modify** tab. Once you have built your trace db, go to the **Global Modify** tab and assign global modifications for station name, channel, location code, and network code as necessary (Figure 11):

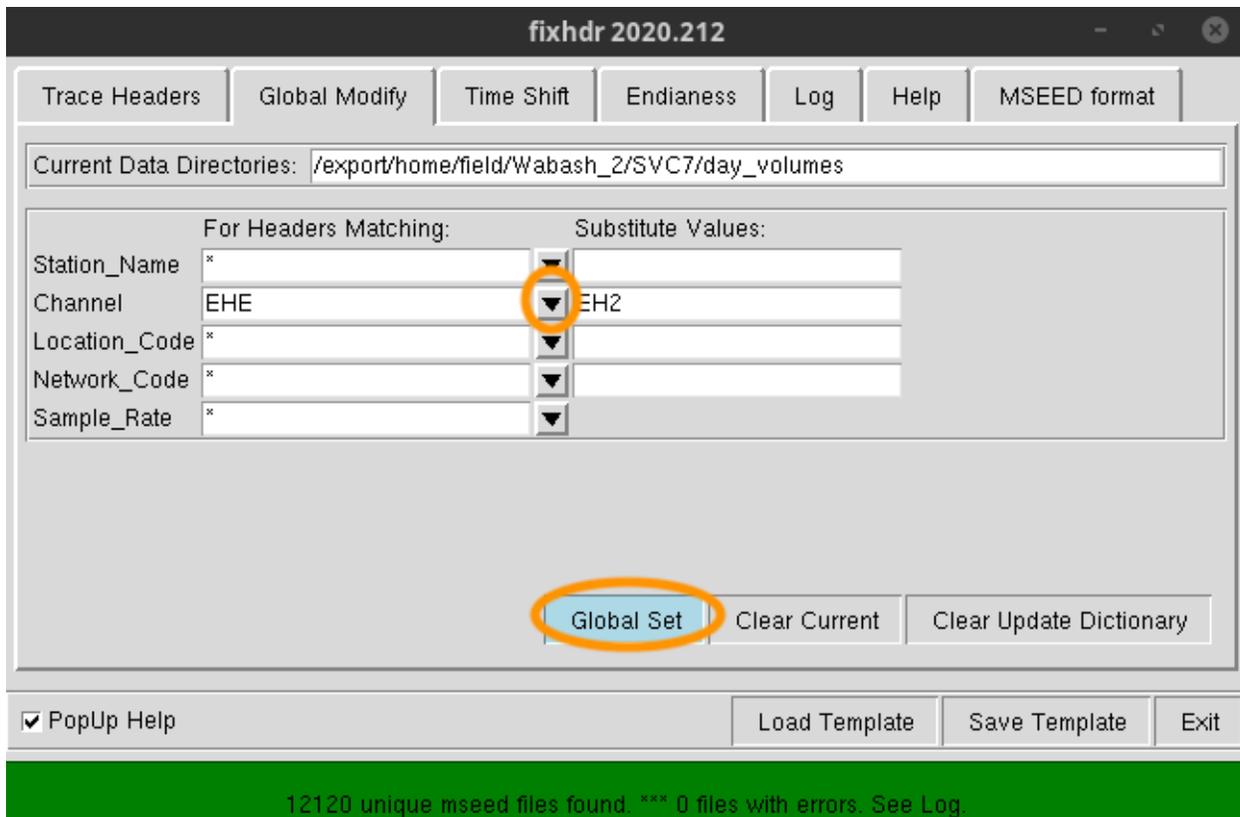


Figure 11 – Global modification of all channel names

From the main GUI select Global Modify, under **For Headers Matching** select the value to be changed, and on the opposite row under **Substitute Values** type in the new value. Click the **Global Set** button.

Note that the row(s) for the header(s) you want to modify will go blank, the color of the **Global Set** button will change, and a message: “Global Set Done. Use ‘Trace Headers’ to apply” will appear at the bottom of the GUI.

- Note: To clear all the Global Sets and start over, click **Clear Update Dictionary**.

You can apply multiple header changes at a time in one **Global Set** run. We recommend that you save the **Global Set** via **Save Template** and review the template before proceeding with changes. When all of the desired header changes are set, go to the **Trace Headers** tab and press **Modify Headers** to implement the changes, as described in section 3. After the changes are complete, build the trace db again and click the drop down for **Stat:Chan:Loc:Net:Sps** to verify the headers were properly fixed. It is also recommended that you save the log file in the **Log** tab, via the **Save Log File** button, for later reference.

Alternatively, you can save the Global Set modifications in a template file for later use in batch mode (see section 6). The saved template file can also be imported to the GUI

with the **Load Template** button and used to operate on the trace db. After loading the template, go to the **Trace Headers** tab and press **Modify Headers** to implement the changes. Then, rebuild the trace db to verify the corrections were correctly applied.

#### 4. Time changes and questionable timing

**fixhdr** has the capability to apply bulk shift timing corrections. The **Time Shift** function in **fixhdr** is primarily used to mark data as timing questionable in cases where the timing of the data is potentially inaccurate due to issues with the GPS locks.

- Note: Be aware that **fixhdr** applies a fixed time correction for each time range and cannot scale the correction to account for drift.

Before beginning, you need to know: 1) sta:loc:net code of the station, 2) time shift to apply, and 3) time range for which the time shift is necessary. If needed, build the trace db as described in section 2.

To apply any timing changes, go to the **Time Shift** tab and use the dropdown to select the traces to which you want to apply timing correction. After you select the station:location:network traces you want to assign timing changes to, **fixhdr** will scan the traces and populate the **Start\_Time** and **End\_Time** fields based on the entire time span of the selected station:location:network traces (Figure 12):

The screenshot displays the 'Time Shift' configuration window in the FIXHDR application. The window has a menu bar at the top with tabs: Trace Headers, Global Modify, Time Shift (active), Endianness, Log, Help, and MSEED format. Below the menu, the 'Current Data Directories' field is set to '/export/home/field/Wabash\_2/SVC7/day\_volumes'. The 'How to Treat Existing Corrections' section has 'Add To' selected. The main configuration area is titled 'For Traces Matching:' and includes a dropdown menu for 'Stat:Loc:Net' (set to 'SB01::6E'), a 'Wildcard Location Code' checkbox, and fields for 'Time Shift:' (Start\_Time: 2015:240:21:56:20, End\_Time: 2015:315:19:00:01, Time\_Shift\_sec: empty) and 'Applied' (checkboxes). A 'Time Tag is questionable:' dropdown is also present. At the bottom, there are buttons for 'List Time Corrections', 'Apply Time Correction' (circled in orange), 'Time Set', 'Recalc Start/End', and 'Clear All'. The footer shows '760 traces selected for key: SB01::6E'.

Figure 12 – Applying time shift

**Tag questionable timing:**

In a case where you have questionable timing, for example if the GPS clock did not lock for a long period of time or had a large phase error (determined after reviewing state of health channels) for part of the deployment, edit the `Start_Time` and/or `End_Time` fields as needed to define the period of time for which timing was questionable, then choose `set` from the `Time Tag is questionable` dropdown, and enter a shift of 0.0 into the `Time_Shift_sec` field (required) (Figure 13).

The screenshot shows a dialog box titled "For Traces Matching:". It contains a dropdown menu for "Stat:Loc:Net" with the value "SB02::6E" and a checkbox for "Wildcard Location Code" which is unchecked. To the right, under "Time Shift:", there are three input fields: "Start\_Time" with the value "2015:240:21:37:35", "End\_Time" with the value "2015:254:23:59:55", and "Time\_Shift\_sec" with the value "0.0". Below these fields is a dropdown menu for "Time Tag is questionable:" with the value "set". On the far right, there are two buttons labeled "Apply".

Figure 13 – Tagging questionable timing

Then, click on the `Apply Time Correction` button, and a pop-up window will appear:

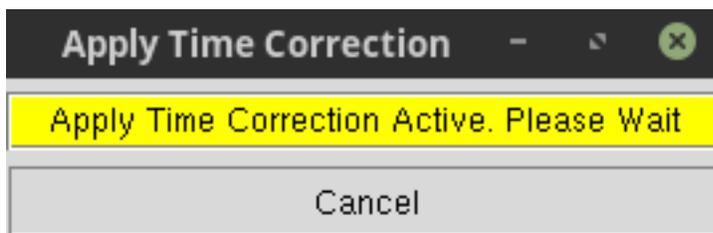


Figure 14 – Pop-up window indicating time correction is being applied

You can view the tagged headers by selecting the `station:location:network` traces you modified from the dropdown, and clicking on the `List Time Corrections` button on the `Time Shift` tab. This produces a pop-up window listing all of the blocks that were modified for each file (Figure 15). (It may take a couple of minutes depending on how many file blocks were changed)

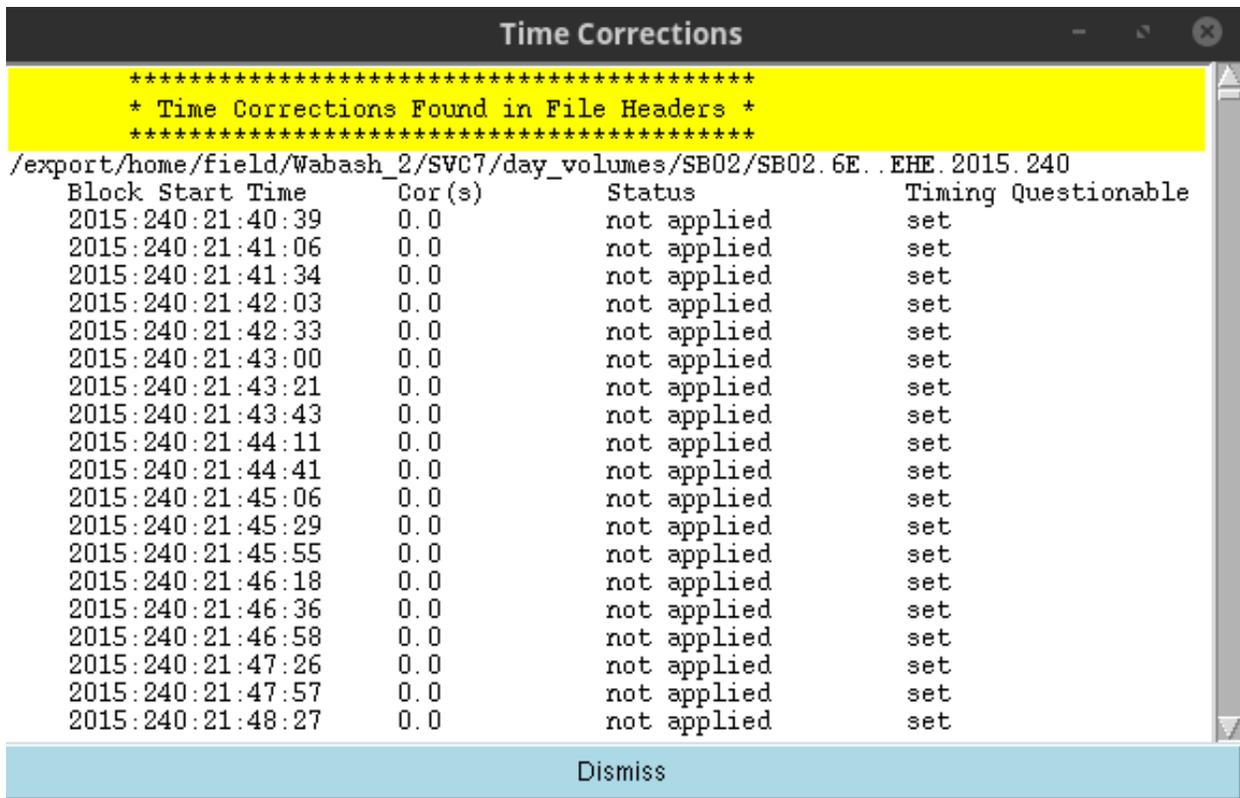


Figure 15 - Pop-up window listing questionable time blocks

### Shift timing:

In the event that you need to apply a timing change to some of your files, select the affected station:location:network from the dropdown as mentioned above, then enter the change in seconds in the `Time_Shift_sec` field. If there was drift, you will need to adjust the start and end times for each fixed time correction to simulate the timing drift. Click on `Apply Time Correction` and wait for it to finish (Figure 16).

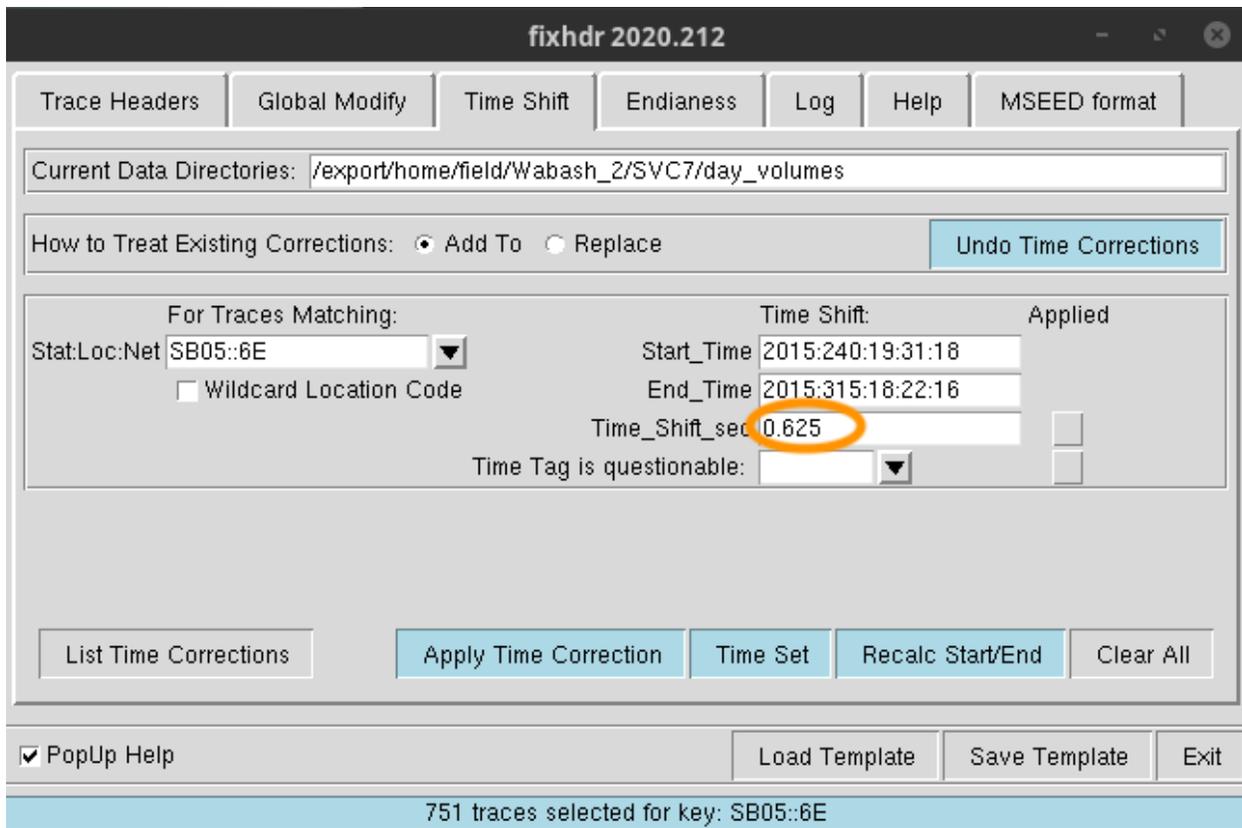


Figure 16 - Time shifting

Click on **List Time Corrections** to view the corrections in the **Time Corrections** pop-up (Figure 17) (allow a couple of minutes for it to load):

```

Time Corrections
*****
* Time Corrections Found in File Headers *
*****
/export/home/field/Wabash_2/SVC7/day_volumes/SB05/SB05.6E..EHE.2015.240
Block Start Time      Cor(s)      Status      Timing Questionable
2015:240:19:52:26    0.625      applied     unset
2015:240:19:52:49    0.625      applied     unset
2015:240:19:53:12    0.625      applied     unset
2015:240:19:53:34    0.625      applied     unset
2015:240:19:53:57    0.625      applied     unset
2015:240:19:54:21    0.625      applied     unset
2015:240:19:54:44    0.625      applied     unset
2015:240:19:55:06    0.625      applied     unset
2015:240:19:55:27    0.625      applied     unset
2015:240:19:55:49    0.625      applied     unset
2015:240:19:56:12    0.625      applied     unset
2015:240:19:56:34    0.625      applied     unset
2015:240:19:56:55    0.625      applied     unset
2015:240:19:57:18    0.625      applied     unset
2015:240:19:57:41    0.625      applied     unset
2015:240:19:58:05    0.625      applied     unset
2015:240:19:58:28    0.625      applied     unset
2015:240:19:58:50    0.625      applied     unset
2015:240:19:59:09    0.625      applied     unset
Dismiss

```

Figure 17 - Pop-up window listing time-shifted data blocks

- Note: Please be aware that **fixhdr** will not exactly apply a time shift that is a multiple of a tenth of a second (e.g. 0.7 s). For example, if it is instructed to apply a time shift of 0.7 s, the correction that appears when you list time corrections will be 0.6999 s instead of 0.7 s.
- Note: Time shift correction may not be completely and accurately reversible, make sure to keep a clean copy of the original data before shifting the times.

## 5. Changing header endianness

All miniSEED files submitted to PASSCAL for archiving should be in big endian byte order. They will likely be this way to start with. An exception might be if you are working on a Mac that was PowerPC compatible, or some Linux systems. A limited number of dataloggers also write miniSEED in little endian. You can use the **Endianness** tab to check if all of your file headers are big endian. Use the **Convert to Big** button if any of the headers are little endian (Figure 18). Use the same process to change miniSEED file headers from big to little endian.

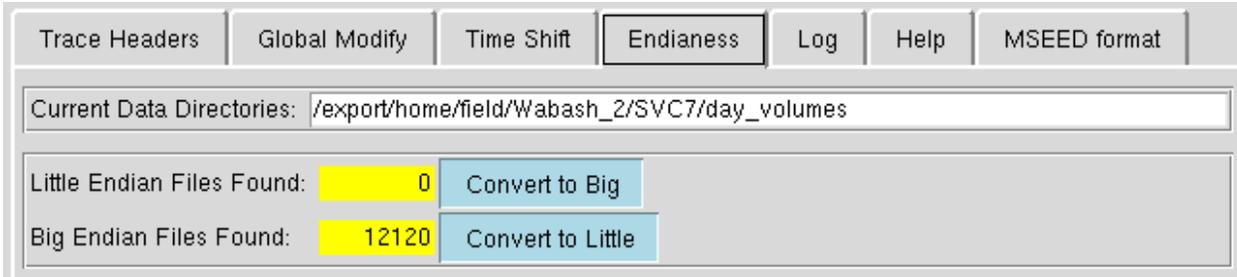


Figure 18 - Changing Endianness

- Note: **fixhdr** only changes endianness of the miniSEED headers; it cannot be used to modify endianness of the waveform data.

## 6. Using fixhdr in batch mode

It is also possible to run **fixhdr** without the GUI, using a batch file as an input with the original and new headers. Type `fixhdr -h` in the terminal to see all options.

A **fixhdr** batch file is a text file formatted like this:

```
# Header Changes
# stat:chan:loc:net:sps  stat:chan:loc:net
hdrlist{
SB01:EHE::6E:100.0    :EH2::
SB01:EHN::6E:100.0    :EH1::
SB02:EHE::6E:100.0    :EH2::
SB02:EHN::6E:100.0    :EH1::
}
```

You can create your **fixhdr** batch file via command line scripting tools, hand editing or using the GUI.

To create a batch file in the **fixhdr** GUI, build the trace db in the **Trace Headers** tab and then go to the **Global Modify** tab. Enter your substitute values and apply **Global Set** as discussed in section 3.1. and click on **Save Template** (Figure 19).

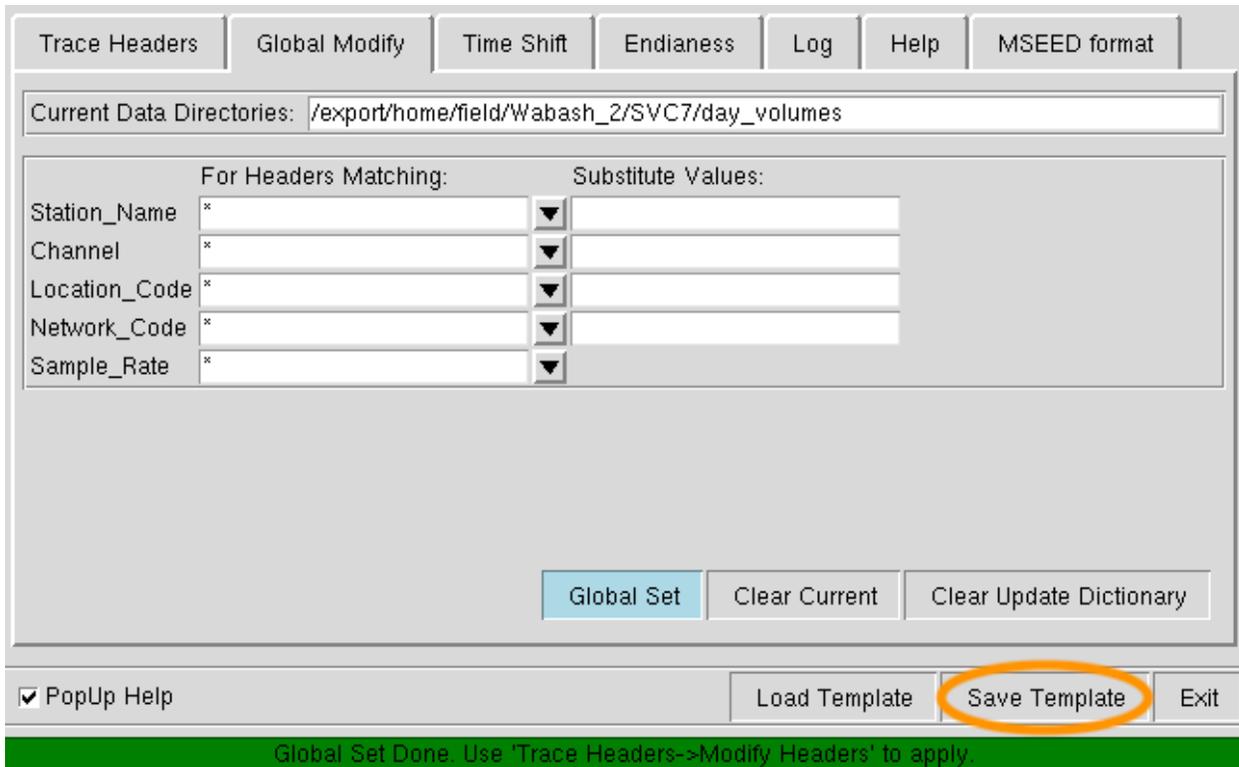


Figure 19 - Save Template to be used in batch mode

This will write a ready-to-use batch file in your current working directory. To run **fixhdr** in batch mode, and make changes to header values, run the following command:

```
fixhdr -d <data directory> -m <batch file>
```

If your files are in multiple directories, you must list the directories (no wildcards) in a colon-separated list. **fixhdr** will print out to the screen what it is working on, as well as the change applied status for all headers in the batch file.

Once completed, you may open the **fixhdr** GUI and rebuild the trace db to verify that all the changes have been applied.