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## Fixity

### Fixity User Guide Version 0.3 2014-01-16

#### Contact information

AudioVisual Preservation Solutions  
<http://www.avpreserve.com>

#### GitHub repository

<https://github.com/avpreserve/fixity>

#### Download pages for application

##### Windows

[http://www.avpreserve.com/wp-content/uploads/2014/01/fixity-win\\_0.3.zip](http://www.avpreserve.com/wp-content/uploads/2014/01/fixity-win_0.3.zip)

##### Mac

Coming Soon

#### Note

**This application is in beta.** Please help refine it further by reporting all bugs to  
<https://github.com/avpreserve/fixity/issues>

#### Change Log

##### 2014-01-13 Version 0.3

- Changed *Save Email/Time to Save Settings* in File Menu. Selecting this saves all project settings.
- Changed *Save and Run* to *Run Now* and altered the way this invokes the scheduler so that it doesn't tie up the Fixity UI.
- Added *Preferences* → *Configure Sender Email* to enable ability to configure Sender Email instead of using [fixityreport@avpreserve.com](mailto:fixityreport@avpreserve.com) as the fixed address. This is a global preference for the application. The email and password are stored using a cryptographic hash to maintain security.
- Added *Preferences* → *Filter Files* to enable users to exclude the scanning and validation of files. This is a project level preference.

- Added *Run when on battery power* checkbox preference to choose whether the scanning and validation tasks should occur when the computer is on battery power/not plugged in. This is a Windows Task Scheduler preference that caused a lot of confusion previously with scheduled tasks 'failing' to run. This was made explicit and placed front and center to make it clearer. If unchecked the application will not run if running on a laptop that is not plugged in. This is a project level preference.
- Added *If missed, run upon restart* checkbox preference that invokes the scheduled task to run when started if it was missed for some reason (e.g. turned off, logged out). If unchecked the application missed scheduled tasks will simply be missed. This is a project level preference.
- Added *Email only upon warning or failure* checkbox preference to leave it up to the user when to receive emailed reports. If unchecked emails will be sent to the identified recipient email addresses every time a scan is performed regardless of the results. This is a project level preference.
- Compiled as 32-bit application so that it will run on 32-bit and 64-bit systems.
- Altered behavior so that saving does not wipe the project manifest
- Updated the reporting terms:
  - *Created* was changed to *New*
  - *Moved* was changed to *Moved or Renamed*
  - *Missing* was changed to *Removed*
  - *Corrupted* was changed to *Changed*
  - *Confirmed* is still *Confirmed*
- Altered behavior so that changed files are updated with their new information after being reported. Therefore a changed file will be reported as changed one time, and if no further changes occur it will not continually be reported as changed.
- Fixed bug that wouldn't allow adding new directories to an existing project.
- Fixed bug that maintained directories in slots 5, 6 and 7 when existent and creating a new project.
- A display issue with name of application in Title bar of application window was corrected.

## 2013-11-22 Version 0.2

- Addressed bug with scheduling issue – task was not generated properly if the file path had a directory with spaces in it.
- Addressed bug with emailing of reports – corrected SMTP configuration
- Changed the code for images so that they display properly
- Moved AutoFixity.exe into schedule folder to avoid confusion
- Other minor code refinements
- Updated User Guide according to user feedback

## Known Issues

- *[ProjectName].tmp* occurs under certain circumstances. Usually when there is an interruption to a scan. This is a minor issue and can be remedied by either ignoring the project or deleting *[ProjectName].tmp* from the Projects folder.
- In the instance where there are multiples of the same file within a project, AND one file is altered, AND THEN altered again so that it is returned to it's original state, the file is reported as a *New* file and a *Copy* of the duplicate file in the project. The correct behavior would be to report this as a *Changed* file and a *Copy* of the duplicate files. This will be addressed in future revisions. In the meantime, the event is still a notable reported event and able to be figured out through review.
- Under certain circumstances when *Run Now* is invoked after a scheduled task is performed, the existing project file is not being detected, resulting in a report of all *New* files as if the project is being run for the first time. This has only been reported on one system to date and has not been able to be replicated by the development team in testing.
- Several files have been reported to crash Fixity. The filenames of the files causing the crashing are very long (~90 characters long) and on a NAS. Likely, the length of the filename is the culprit but further testing and information is required.
- If a scan is scheduled and does not have access to the project directories (i.e. is not logged on to a server or a removable drive is unavailable) it will report the files as missing. When run again with access to the project directories it will report the files as new.

## Brief overview and background

Fixity is a utility for the documentation and regular review of stored files. Fixity scans a folder or directory, creating a manifest of the files including their file paths and their checksums, against which a regular comparative analysis can be run. Fixity monitors **file integrity** through generation and validation of checksums, and **file attendance** through monitoring and reporting on new, missing, moved and renamed files.

AVPreserve created Fixity after coming to the realization that:

1. Checksum generation and validation are universally recognized as a primary mechanism for fulfilling the goal of fixity.
2. Generating checksums without systematically and routinely validating them is of little or no use.
3. Most organizations that “use checksums” only generate checksums but do not validate them routinely, if at all.

4. The primary reason organizations do not systematically and routinely verify checksums is because there is no tool that allows scheduling and reporting of validation.
5. Organizations that do routinely verify checksums do not typically monitor and report on file attendance types of information.
6. Overcoming the lack of resources and/or access to IT expertise is a critical factor in enabling organizations to fulfill the goal of fixity. Organizations need a simple, low cost tool.

Fixity was created with the sole focus of fulfilling the requirements of those concerned with monitoring fixity of a collection over the long term. There are many free and open source checksum utilities out on the market, but they do not offer the feature set or simplicity necessary to fulfill the needs of many organizations. It is intended for use in monitoring collections of files that are “final state”, or ready for deposit into an archive or preservation oriented repository.

## The Fixity folder

When you download and unzip Fixity, the executable files, as well as the folders for your future projects, reports, and schedules, are stored within the parent directory.

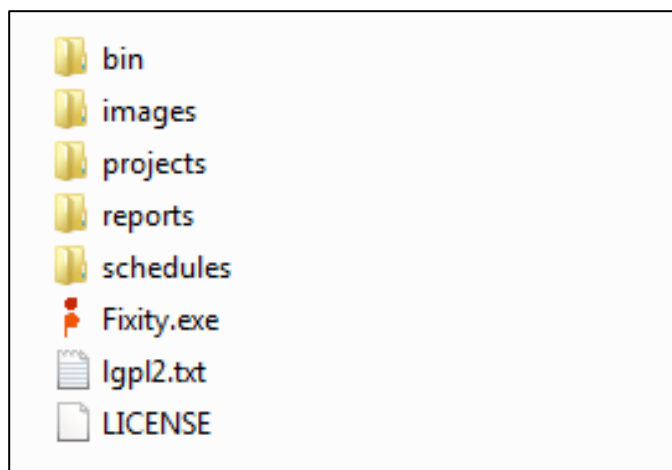


Figure 1. Fixity directory structure

This directory can be placed anywhere on your computer but it must stay formatted as-is; if you move Fixity.exe or any of the directories from the parent folder the program will not function. If you wish, you can create shortcuts to the executable file and directories in a more convenient location.

**Note:** The AutoFixity.exe file located in the *schedules* folder is invoked during the scheduled run of Fixity, and does not need to be run manually. It should stay in place and should not be executed via double-clicking.

## Fixity interface

Fixity has a simple graphical user interface (GUI). The following text details the behaviors of each section of the interface from left to right.

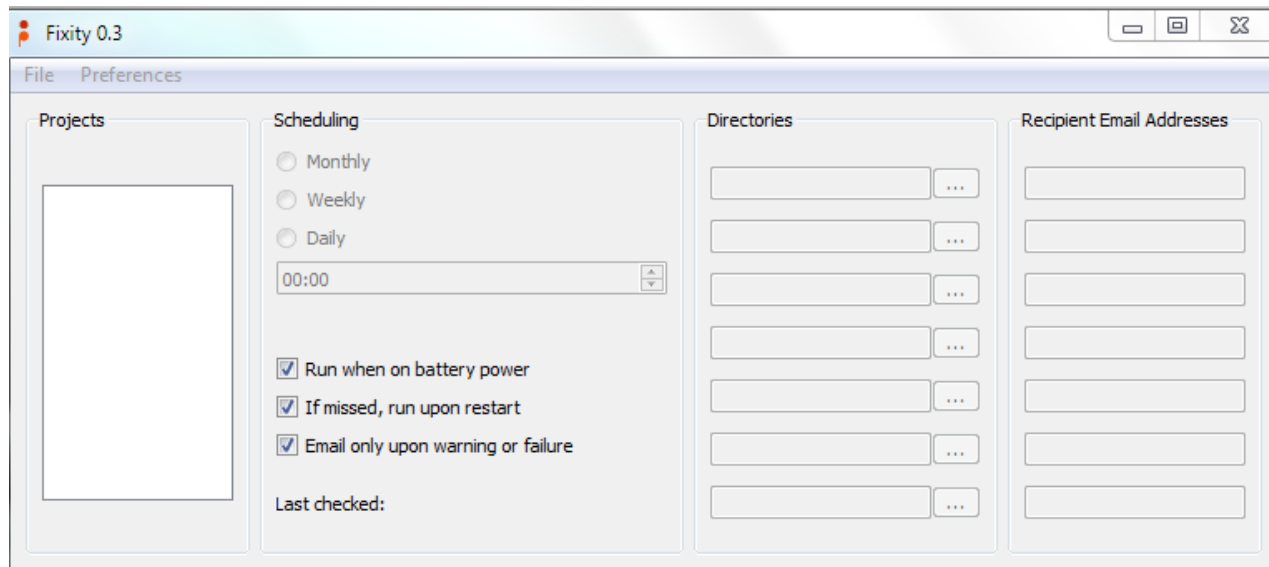


Figure 2. Screenshot of Fixity Version 0.3 interface.

**Projects:** As you create new projects, the project names you have chosen will appear in this box. Click on a project name to view its settings in the rest of the window.

**Scheduling:** You can set the schedule for generating/validating checksums and file attendance in this section. Using the radio buttons, you can choose between a monthly, weekly, or daily scan.


- **Monthly:** If you choose this option, you will be presented with two boxes. The box containing “00:00” is where you enter the time (in military time and in reference to the date and time settings of your computer) that you want the validation to begin. The second box scrolls through numbers from 1 to 31, allowing you to choose the day of the month you wish the scan to run.
- **Weekly:** If you choose this option, you will be presented with two boxes. The box containing “00:00” is where you enter the time (in military time and in reference to the date and time settings of your computer) that you want the validation to begin. The second box allows you to choose the day of the week you wish the scan to run.
- **Daily:** If you choose this option, you will be presented with one box. This box is where you enter the time (in military time and in reference to the date and time settings of your computer) that you want the validation to begin each day.

The **Scheduling** section also contains settings for the behavior of the scheduled task.

- **Run when on battery power.** If Fixity is being run on a laptop, check this option to allow Fixity to run when operating on battery power. Note that this option does not affect non-battery powered systems.

- *If missed, run upon restart:* If this is selected, Fixity will run upon startup if it missed a scan (e.g. due to the system being powered off). Otherwise, it will run at the next scheduled time if a scan is missed.
- *Email only upon warning or failure:* If selected, Fixity will only send email reports when a change is detected during a scan. Otherwise, it will send an email following each and every completed scan.

Lastly, in the *Scheduling* column, Fixity displays the date and time of your project's most recent scan.

**Directories:**  Click on this button next to the text field to select the specific directory that you wish to scan. You can select up to 7 directories per project.

**Email Addresses:** Every time Fixity scans a directory, a report is generated. In each of your projects, you can choose up to 7 email addresses to have this report sent to based on the preference *Email only upon warning or failure*. Simply enter one email address in each of the seven fields below *Email Addresses*.

## Fixity file menu

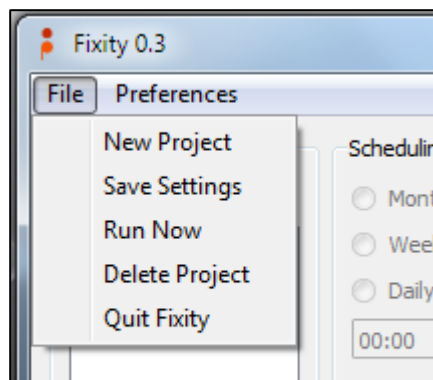


Figure 3. Detail of Fixity File menu.

**New Project:** Choose this option each time you wish to set up a new project. A project contains the settings for the scheduling, directories and recipient email address sections. You will be prompted to name your project. Note: A project name may not contain spaces.

**Save Settings:** When you are satisfied with your project's parameters, click this option to save it to the project folder. The project file contains the settings for the scheduling, directories and recipient email address sections. Note that unlike previous versions, saving settings does not invoke a fixity check scan at the time of saving.

**Run Now:** Invokes a fixity scan. If it is the first time a scan is being run for a project it will perform the initial scan. If a scan has already been performed it will validate against the existing data.

**Delete Project:** Choose this option if you wish to delete a project completely.

## Fixity preferences menu

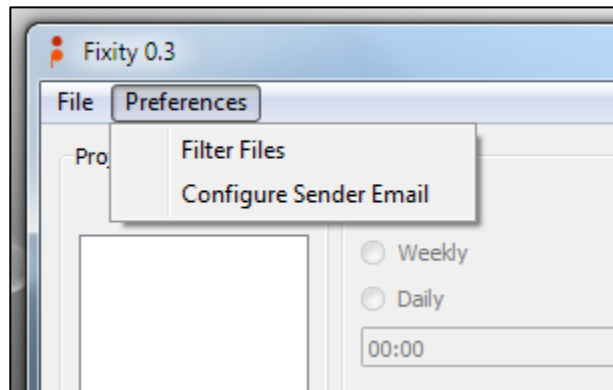


Figure 4. Detail of Fixity Preferences menu

### Filter File

The Filter File window (Figure 5) allows the user to create pattern-matching filters to prevent Fixity from scanning files. For example, a repository may not want to include the *DS\_Store* or *Thumbs.db* files created by default by certain operating systems. These can be blocked from scans by adding them to the filter.

The filter interface contains a drop-down menu of projects, from which one can select a project to set filters for. In the text box, a comma-separated list of case-sensitive patterns to block can be set. For example, the settings in the screenshot below will ensure that files containing *DS\_Store*, *Thumbs.db*, *tmp* as part of their name will not be included in the scan. *Set Information* must be selected to save the filter information before closing.

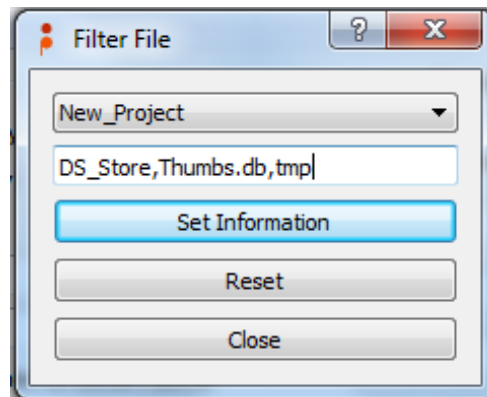


Figure 5. Fixity Filter File detail with sample patterns to block.

### Configure Sender Email

Figure 6 demonstrates how Fixity allows the user to provide email credentials for whichever email account they would like to use for sending Fixity reports. Without setting this preference, Fixity will not be able to send report emails. Note that Fixity will encrypt the credentials before storing it to provide for account security.

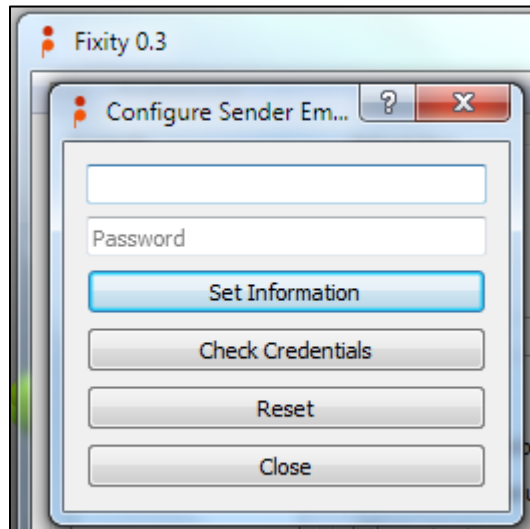


Figure 6. Fixity Sender Email detail.

Selecting *Confirm Address* will test the sender email account by sending an email to itself. If the email is received then everything is working. Note: If you are not receiving the test email in your inbox, check your spam folder.

## Fixity analysis and reporting

### Fixity report

A Fixity report is saved to the *reports* folder and emailed to the recipient email addresses identified in the project according to the *Email only upon warning or failure* preference. The Fixity report is named *report\_yyyy-mm-dd-hhmmss.csv* where *hhmmss* is in military time.

1	Fixity report	
2	Project name	C:\Users\AVPSAD~1\AppData\Local\Temp\Fixity0.3\Fixity0.3\Test001
3	Algorithm used	sha256
4	Date	1/14/2014
5	Total Files	5
6	Confirmed Files	1
7	Moved or Renamed Files	1
8	New Files	2
9	Changed Files	0
10	Removed Files	1
11	New File	C:\Users\AVPS Admin\Desktop\New folder\failfile_sender.png
12	Moved or Renamed Files	C:\Users\AVPS Admin\Desktop\New folder\fixity_filemenu2.png
13	Confirmed Files	C:\Users\AVPS Admin\Desktop\New folder\fixity_preferences menu.png
14	New Files	C:\Users\AVPS Admin\Desktop\New folder\fixity_senderemail.png
15	Removed Files	C:\Users\AVPS Admin\Desktop\New folder\sender\fixity_senderemail.png

Figure 7. Detail of a sample Fixity report.



When opening Fixity reports in spreadsheet applications it is important to open them by importing the CSV and identifying the delimiter as a Tab. This will make sure that the status data is in column A and the filepath data is in column B. This will allow filtering and sorting. Fixity reports contain the following information:

*Fixity report:* Identifies the report as a Fixity report

*Project name:* Provides the name of the project for which the report was generated

*Algorithm used:* Identifies the hash algorithm used to compute the checksums for the files scanned.

*Date:* The date that the report was generated.

*Total Files:* Total files scanned and/or removed. It is the sum of all of the below categories in any single scan.

*Confirmed Files:* The number of files scanned that exist in the manifest where the filepath, hash value, and inode value are the same.

*Moved or Renamed Files:* The number of files that existed in the manifest previously which have the same hash value and inode value, but a different filepath.

*New Files:* The number of files scanned that did not previously exist in the manifest. It is important to note that “New Files” are not moved or renamed files previously in the manifest under a different filepath.

*Changed Files:* The number of files that existed in the manifest previously and have a new hash value.

*Removed Files:* The number of files that existed in the manifest previously which are no longer there and have not been renamed or moved.

Each row beneath *Removed Files* provides a filepath and the associated status of the identified file for all files scanned and/or removed in a project. Files that have been filtered out using the *Filter File* preference will not appear because they will not have been scanned.

## Analysis and reporting logic

Figure 8 aims to support users in interpreting reporting by presenting various scenarios and results in an easy-to-read table with Y[es] or N[o] indicators and the outcomes.

The chart denotes:

- if a file that is present in the manifest is present in a target directory,
- if a file has the same hash value, filepath, and inode upon comparison, and
- what the results would be for each scenario.

File present?	Same hash?	Same filepath?	Same inode?	Result
Y	N	Y	Y	Changed File
Y	N	N	Y	Changed File
Y	N	Y	N	Changed File
Y	Y	Y	Y	Confirmed File
Y	Y	Y	N	Confirmed File
Y	Y	N	Y	Moved or Renamed File
Y	Y	N	N	Moved or Renamed File
Y	None	None	None	New File
N	Existing	Existing	Existing	Removed File

Figure 8. Fixity Version 0.3 reporting chart

### Fixity reporting behavior

When changes are identified, Fixity behaves in the following ways upon finding changes:

- New files are added to the manifest and checksums are generated for them
- Removed files are removed from the manifest
- Moved files are updated with their new location in the manifest
- Renamed files are updated with their new name in the manifest
- Changed files are updated with new hashes in the manifest

### Frequently asked questions (FAQs)

*Note: This application is in beta. Please help refine it further by reporting all bugs to <https://github.com/avpreserve/fixity/issues>*

*Q: Will Fixity perform a scheduled scan if the application is not open?*

A: Yes.

*Q: Will Fixity perform a scheduled scan if the computer is turned off?*

A: No. If the project is set to scan on restart, then it will attempt to perform the scan as soon as possible.

*Q: What is the .fxy file in the project directory?*

A: The .fxy file found in the project directory contains the information for a given project. There is no need to alter the file directly – it should only be edited via Fixity.

The structure of the .fxy file is as follows:

Root directories to scan  
Email addresses to alert  
Schedule information  
Date and time of last run  
File checksum   Filepath   File inode

More information on these values can be found in the program source code.

*Q: How is scheduling performed within Windows?*

A: Fixity uses Windows' SCHEDULE tasks with AutoFixity to set/update/delete scheduled tasks.