

Cylinder Digitization Procedure

Inspect cylinder-

Look for chips, cracks, bumps, holes or any other physical characteristics that would damage the machine, or the cylinder even further when attempting to play. Cylinders that are too damaged to play should be noted in the POD, and set aside for a possible optical transfer. In the Physical Object side of the POD, note the size of the cylinder, material, groove pitch, playback speed, recording method, structural damage, and any other preservation problems.

Preparation –

Cylinders should adjust to the room conditions for at least 3-4 hours before attempting to play (overnight is ideal).

Take cylinder out with two fingers on your left hand. This is so the cylinder can easily be placed onto the mandrel. Clean inside and out with camel hair brushes and canned air. Look for inside debris and brush out into a trash can. 4 minute black wax cylinders are known to cracking due to pressure from debris on the inside. Slide the cylinder onto the mandrel until it grips the wider end. Gently give it a twist until the cylinder is firmly on the mandrel. Notice if there is any space between the tapered side of the mandrel and the left side of the cylinder. If so, use paper shims to get the cylinder to stay firm on the mandrel so it does not wiggle or move.

Centering –

The Endpoint machine provides a reference tone to correct for wow & flutter, however it is best to reduce as much of the wow and flutter caused by both velocity error & velocity inertia as possible by centering the cylinder to the mandrel. With the cylinder in place, lock the mandrel and turn on Hi-Resolution Mode. This will display the distance from the laser to the cylinder surface to the micron (0.003). Set the start and end points of the cylinder by pressing and holding the appropriate button for 2 seconds. These are the points just before and after the outermost grooves of the cylinder, and not the physical cylinder itself. Take a read out by setting the mandrel to the non-adjustable side (black or red circle), and press the mandrel set button. Turn the mandrel 180 degrees to the adjustable side (black or red line) and use the specialized screwdriver to adjust the mandrel until the numbers on the display read out match. Once the black and red points are aligned, go to the end point and repeat the previous step, adjusting the smaller side of the mandrel. After the black and red points are aligned, go back to the beginning and adjust both points one more time. Unlock the mandrel and press “spin”, to visually verify that the cylinder is properly centered.

When a cylinder needs to be captured in reverse, lock the mandrel, remove the head shell to ensure the cylinder does not get scratched, insert the locking pin into the right side of the mandrel and spin counter-clockwise. This will remove the mandrel assembly and allow it to be flipped. Screw in the

tapered side until it is firmly connected, remove the locking pin, and re-attached the head shell. Set your new starting and ending points, and re-center the cylinder.

When digitizing in reverse, it is important to invert the polarity of the Left and Right signals.

Tonearm, cartridge, and styli assemblies –

We typically want to stay between 4.5g – 7.5g. A tracking force that is too light can cause the stylus to “bounce”, and potentially damage the cylinder. The current tracking force is set to 4.5 grams. The tonearm has the ability to apply either ‘Anti’ or ‘Pro’ skating to help with tracking.

The cartridge is the Shure V15Vx Microridge, with the wires flipped for vertically cut grooves.

Stylus selection – Start a test recording, and play the same section of cylinder using different styli sizes. Sometimes it is best to audition the cylinder somewhere the middle due to the beginning and end usually having some issues. Start with the 8.5, then the 14, 10, and 7.5 Conical. Notice differences in the character of the sound, signal to noise ratio, high frequency content, and overall intelligibility. Go back and listen to the test file and make the best selection.

Styli sizes:

.014 x .0037"EFCR

.010 x .0037"EFCR

.008 x .0040"EFCR

.0075"FCR

.006 x .0030"EFCR

Cantilevers – It is OK to use a 2 minute cantilever on a 4 minute cylinder, but not the other way around.

SS53C Blue Stylus Assembly – 4 minute cylinders – 4.5 grams

SS35C Green Stylus Assembly – more high frequency response – 3.5 grams

Determining Speed-

This is one of the biggest challenges digitizing cylinders, and can be highly subjective. Most of the field recordings are not standard speeds. Listen for pitched instruments, characteristics of the human voice (man, woman, or child), hard consonant sounds like, ‘g’ and ‘k’, and continuity within the collection itself.

Some Standard speeds – 120RPM - 144 RPM - 160RPM

Dictation – 6" Dictaphone – 90 RPM

Digitization-

Once the cylinder has been inspected, cleaned, and centered; and the best possible stylus and speed have been chosen, you are ready to digitize. Check the null point by switching the Timestep over to Vertical Mode (the cartridge polarity has already been flipped in the head shell) and sweep the left & right signals using the ‘Blend’ knob, and listen for the point at which there is the least amount of signal.

This ensures that you are summing the two channels correctly. Switch back to L+R mode, and set your level. Ideal levels for the Intermediate file are between -12db and -7db. There is to be no EQ added at this stage.

Make sure that Wavelab is set to record a WAV (PCM) Multi Stereo/Mono 24/96 kHz file.

Set Wavelab to record inputs 1-4, with the Left & Right flat output of the Timestep going to input 1 & 2, the mono summed output of the Timestep to input 3, and the Endpoint Audio reference tone going to input 4 (this will create a stereo file and allow the 'PresInt' and 'PresInt Reference tone' to be edited at the same time.) Clean the cylinder and stylus tip one more time before digitizing. Start the Wavelab and Tascam recording at the same time, then start recording on the Denon. Make sure that every groove on the cylinder is captured.

Tracking Issues-

Locked grooves are some of the most common issues faced with tracking cylinders. When you encounter a locked groove, see if you can help the stylus along by hand, or with a fine tipped brush. It can be very difficult to capture the very next groove after a locked one, so this may require capturing the content in reverse and editing the two points together in the Intermediate file.

Cracks can be very troublesome. Be very careful when putting a cracked cylinder onto the mandrel. There is a good chance that it will make the crack even worse, or break completely. If there are any doubts about the stability of the cylinder, DO NOT attempt to play it.

If the cracks are minor and the cylinder can still be played, place a piece of tape around the edge after it is on the mandrel. This will help to not crack the cylinder even further as it spins on the mandrel. It is a good idea to avoid over-playing a cracked cylinder as much as possible. It is also a good idea to transfer a cracked cylinder at half speed to reduce the amount of pressure being applied to it.

Skating can occur when dealing with under modulated or shallow grooves. Apply Anti or Pro skating as needed. During Nick's installation, he applied a slight Anti skating bias to the tonearm for better tracking results.

Cylinder File Types-

Preservation Master – This is the primary surrogate for long-term preservation. It carries the raw material from the transfer and is complete, un-altered, un-equalized, and un-edited.

Preservation Master Reference Tone – a 440 Hz tone mono file that is an exact match of the Preservation Master. Used for correcting time based instabilities from playback of the cylinder.

Preservation Master-Intermediate- A faithful representation of the source recording. It is considered a co-master and a valid stand in for the preservation master. It is mono-summed, top & tailed, un-equalized. Locked grooved sections are removed, reversed content is in the forward direction.

Preservation Master-Intermediate Reference Tone - a 440 Hz tone mono file that is an exact match of the Preservation Master-Intermediate. Make edits to both the *Int* and *IntRef* files at the same time by editing them as a single stereo file. When finished, save them as separate mono files.

Production Master – The file that is used to generate all further derivatives. It is a representation of the source recording that may be optimized for presentation to end-users.

Current Signal processing chain for Production Masters-

Izotope RX Dialouge De-Noise –

Manual noise profile detection setting
Band 1 @ -57db
Band 2 @ -78db
Band 3 @ -76db
Band 4 @ 74db
Band 6 @ -61db
Band 7 @ -40db
Threshold @ -10.4
Reduction @ 7.5
Input @ 0db
Output @ +2.5db

Izotope RX De-click

Algorithm setting -Single band
Click type setting - click
Sensitivity setting @ 1.9

Izotope RX De-clip (optional)

Threshold setting @ -16.1
Makeup gain @ -1.3

Fab Filter Pro Q2

Band pass 72db/oct – 1349Hz / 0db / Q 0.190
Bell curve 12db/oct – 339Hz / +2.4db / Q 3.510
Bell Curve 12db/oct – 683.87 Hz / +3.6db / Q 1.380
Bell Curve 12db/oct – 1021.1Hz / +6.73db / Q 3.104

Under sampling-

Whether it is cracks, locked grooves, or other tracking issues, a cylinder may benefit from a half speed transfer. When a cylinder needs to be played at half speed, follow these steps to under sample.

- Close Wavelab, take the Lynx Mixer out of *SynchroLock* and set to “*Internal*”.
- Change the sample rate on the Prism and the Tascam to 48 kHz.
- Set the Lynx Mixer to “*Digital In 1*”, and turn on *SynchroLock*. Wait until the light turns green.
- Open Wavelab, and start digitizing the cylinder at half speed.
- After digitizing, save the files, close Wavelab, and reverse the above steps so that you are set to 96 kHz.
- Once you open Wavelab again, the files will playback at the desired speed.
- Make sure to sample convert your Tascam file to 96 kHz before running the Interstitial check.

Time-stretching-

This sort of processing uses algorithms that can add unwanted artifacts into the audio. Under sampling is the preferred method, however, sometimes it is necessary to capture certain sections at quarter speed. Time stretching within Wavelab is not the preferred method of playing back slow speed content, but is acceptable for 1-2 grooves when all other methods are unsuccessful. Apply this as needed to the Preservation Master-Intermediate file.

POD Metadata –

Technical Metadata – Note the size, material, groove pitch, playback speed, recording method, indication of mold or efflorescence, and any damage or preservation problems that have occurred.

Digital Provenance for Preservation Master – Identify all sections in the un-edited file in the comments section and the times that they occur. Note where the “*Target Audio*” begins and ends in the file, and any other sections that are to be edited together with the Target Audio. Note false starts, several attempts at a certain section, locked grooves, reverse captures, etc.

Digital Provenance for Preservation Master-Intermediate- All edits made should be noted in the Pres Master

Digital Provenance for Production Master – Note the plugins used in the signal chain.

Indicate in the comments section for each file the appropriate characteristics found in the transfer; Groove echo, over modulation, under sampling, etc.