

Sing to Me

The HP ScanJet 3c/4c scanner uses variable y-direction scanning. This means that the scan head travels at different speeds dependent on the y resolution. This also means that the stepper motor runs at variable frequencies.

Musical notes are air vibrations at given frequencies. Play Tune (Esc*0M) is an SCL (Scanner Control Language) command that can be used to make the scanner play any song downloaded into its buffer. The song can be loaded into the scanner's internal buffer using the SCSI write buffer command. The format for the song is: number of notes (2 bytes), note one, note two, etc. Each note is three bytes. All numbers are in hexadecimal format.

The first two bytes of each note specify the number of 3-MHz clock cycles between full motor steps for the desired speed. The third byte is the note duration in multiples of approximately 1/8 second. For example, middle C is 256 Hz. The clock frequency is 3 MHz, and the motor half-steps. For middle C, therefore, $3,000,000 \text{ clocks per second} \times 1/256 \text{ second per full step} \times 1/2 \text{ full step per half step} = 5859 \text{ clocks per full step}$, which in hexadecimal is 16E3. For the third byte, a 4 would move the motor for 1/2 second ($4/8 = 1/2$). Thus, to get the scanner to play a 1/2-second middle C, the number to download is 16E3, 4.

For a rest between notes, set the frequency to zero and the duration to the desired length of the rest. When playing notes, the scan head always moves towards the center of the scanner and any frequency above the maximum scan rate of the scanner is truncated to the maximum scanning speed. This gives the ScanJet 3c/4c a three-octave range with the lowest note at about D below middle C.

Here is a well-known tune by Mozart (don't download the spaces or commas):

```
02f
16E3,6 16E3,6 0f47,6 0f47,6 0d9c,6 0d9c,6 0f47,9 00,2
1125,6 1125,6 122a,6 122a,6 1464,6 1464,6 16E3,9 00,2
0f47,6 0f47,6 1125,6 1125,6 122a,6 122a,6 1464,9 00,2
0f47,6 0f47,6 1125,6 1125,6 122a,6 122a,6 1464,9 00,2
16E3,6 16E3,6 0f47,6 0f47,6 0d9c,6 0d9c,6 0f47,9 00,2
1125,6 1125,6 122a,6 122a,6 1464,6 1464,6 16E3,9
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